CAMERA SET, STILL PICTURE KS-15(4)

Repair Training Program

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CAMERA SET, STILL PICTURE KS-15(4)

REPAIR TRAINING PROGRAM

Government Contract F-42600-68-C-3249

INTRODUCTION

The purpose of the training program is to train experienced camera repairmen in the repair adjustment and maintenance of components of the KS-15(4) Camera Set.

The course consists of 120 hours (3 weeks) and includes general functioning of the equipment and practical work.

This text has been prepared especially for the course and is in two parts:

Part 1. TEXT

Part 2. ILLUSTRATIONS

Course conducted at

E. Leitz, Inc.
304 Hudson Street
New York, N.Y.

CHAPTER I

GENERAL FUNCTIONING

Section I. CAMERA BODY

I–1. General Description

The camera body, lenses and accessories supplied with the KS–15(4) Camera Set, together with the LE–11A photographic accessory Kit, is designed for general photographic use. It may be employed in the field, studio or laboratory. It uses 35mm perforated film (black–&–white or color) and mounts interchangeable lenses for wide-angle, normal and telephoto photography. Accessories extend the range to include close-up and photomacrography. The compensating focalplane shutter is self-capping. It is synchronized for flash bulbs at all speeds (1–second to 1/1000–second) and for electronic flash at shutter speeds up to and including 1/50–second. The winding lever simultaneously tensions the shutter, advances the film and actuates the frame counter. The built-in rangefinder couples to interchangeable lenses having focal lengths from 21mm through 135mm, and may be used either as a coincident or split-image type. Bright-line frames, outlining the field, are positioned in the viewfinder when mounting the 35mm, 50mm, 90mm or 135mm f/2.8 lens. Parallax is automatically adjusted while focusing. A delayed action release serves as a self-timer, or for shutter release when using an unsteady support.

I–2. Shutter

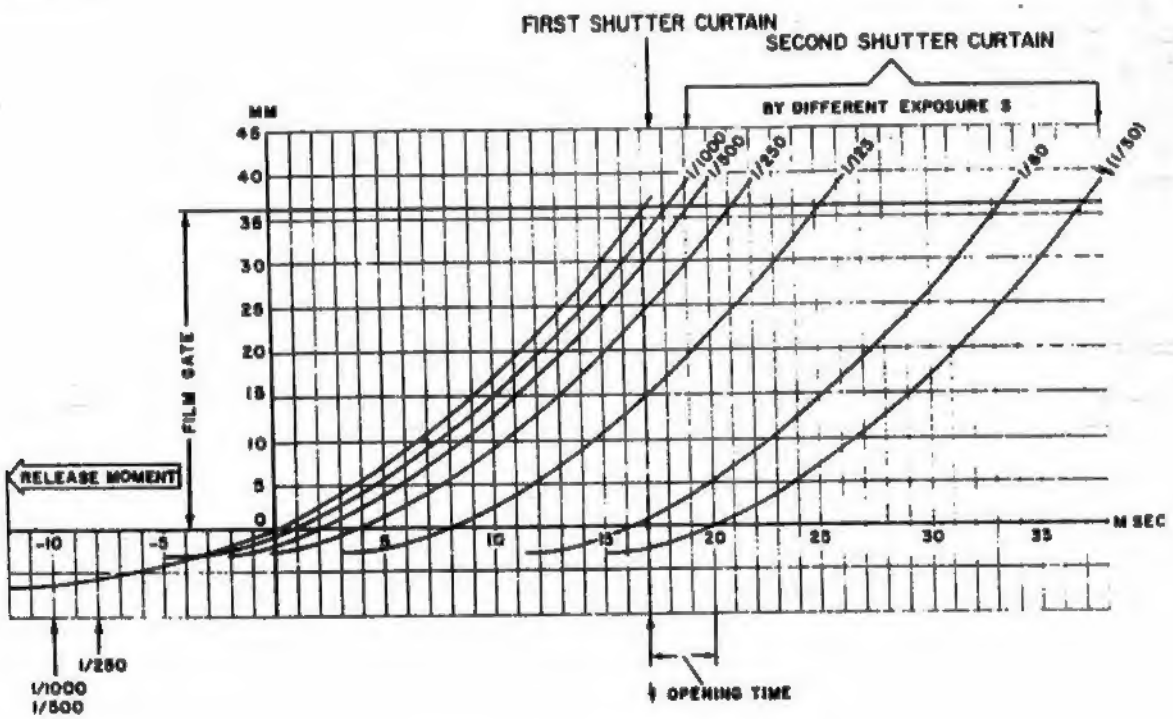

Figure 1–1. Shutter Functioning.

The focal plane shutter employs two curtains of rubberized fabric which operate independently of each other. When the shutter is released the first curtain begins its travel across the film aperture and uncovers a portion of the film. At a later interval, determined by the selected shutter speed, the second curtain is released, starts across the aperture and covers the film. The trailing edge of the first curtain,

and the leading edge of the second curtain form a slit as they traverse the film aperture. The more narrow the slit (shorter interval before release of second curtain) the shorter the exposure; the wider the slit (longer interval between release of first and second curtain) the longer the exposure. Accurate exposure (slit width) is mechanically controlled by cams and levers. At the slower speeds (1–second to 1/30–second) an escapement is engaged and further delays release of the second curtain. At shutter speeds of 1/50–second and slower, the first curtain completely uncovers the film before the second curtain is released. When the shutter is wound both curtains lie approximately 7-millimeters behind the edge of the film aperture. When the shutter is released the curtains travel together for approximately 4-millimeters, at which point the second curtain is arrested. The trailing edge of the first curtain enters the film aperture approximately 12-milliseconds after release of the shutter. The time required for the curtain to traverse the aperture is approximately 17-milliseconds (1/59–second). The shutter curtains, overcoming inertia during their travel, move faster as they cross the film aperture. To assure even exposure of the film, the slit must widen as the curtains move across the aperture. This is accomplished by the increasing diameter of shutter curtain and ribbon rollers as material is wound on them, and by different tensioning of the shutter springs. A brake mechanism applies a gradual braking action to the shutter curtains as they near the end of their run. This prevents an abrupt stop of the curtains and lessens camera vibration.

a. Shutter Winding (fig. 1–2, 1–3, 1–4, 1–5, 1–6). The shutter is wound and the film advanced one frame by operating the winding lever through a complete stroke. The shutter may also be wound by completing a "stroke cycle" with a series of short intermittent strokes of the winding lever.

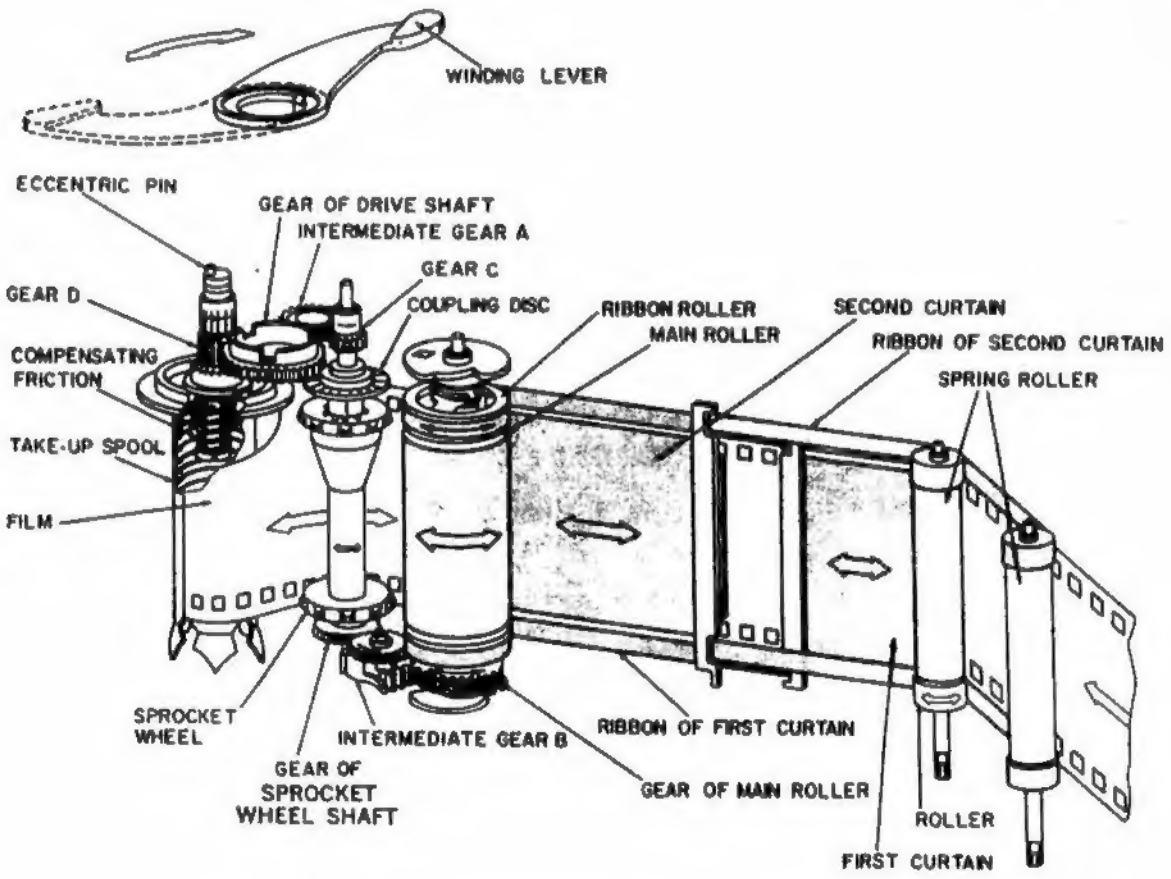

Figure 1–2. Film Transport and Shutter, Schematic.

(1) The driveshaft gear (fig. 1–2) rotates counter-clockwise as the winding lever is moved through its operating arc. Intermediate gear "A" meshes with gear "C" of the sprocked wheel shaft.

(2) Two stop discs on top of gear "C", in conjunction with two stop levers (fig. 1–3), control the stroke of the winding lever, film advance and exact shutter winding.

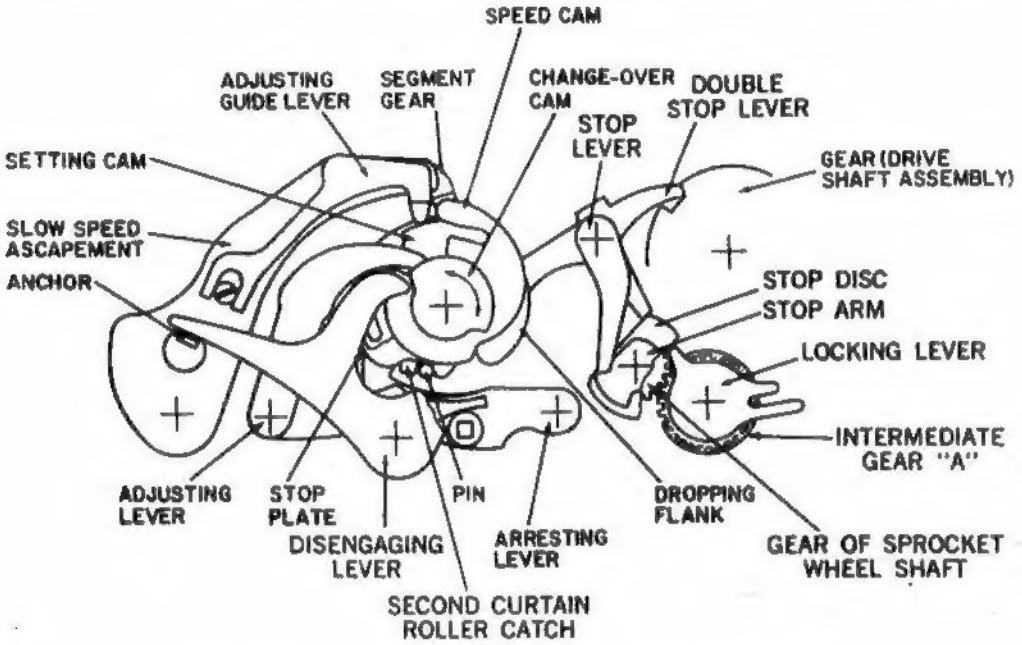

Figure 1–3. Shutter Winding and Speed Controls.

(3) The lock lever, resting on intermediate gear "A" (fig. 1–3), prevents reverse rotation of the sprocket wheel shaft if the winding operation is interrupted.

(4) The lower gear (fig. 1–2) on the sprocket wheel shaft meshes with two-part intermediate gear "B" which engages a gear on the main shutter roller shaft. Operation of the winding lever rotates the main shutter roller through the gears. This simultaneously winds the second curtain on to the main roller; and by shutter curtain ribbons, pulls the first shutter curtain across the film aperture and tensions the springs of the spring rollers.

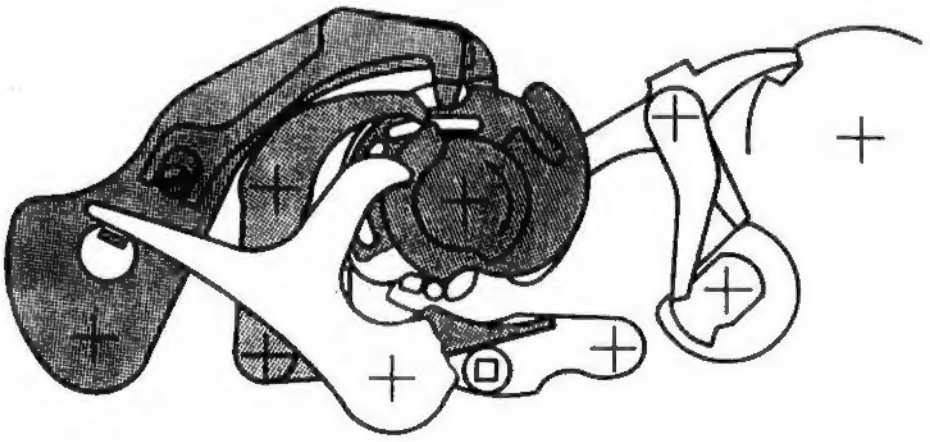

Figure 1–4. Controls in 1-Second Position, Shutter Wound.

(5) When the shutter is fully wound (fig. 1–4), one of the lower ends of the spring-loaded double-stop lever engages a notch on the under-side of the driveshaft gear. This prevents the winding mechanism from being overdriven.

b. Shutter Speed Adjustment. Shutter speeds are selected by setting the shutter speed dial to the desired index. This adjusts the shutter control cams and levers which regulate the release of the second shutter curtain and consequent slit width.

(1) *Shutter speed dial set for "B".* Figure 1–3 illustrates the position of shutter control cams and levers when the shutter is wound. The slow-speed escapement is disengaged. The shutter slit adjusting and arresting levers are positioned to prevent release of the second shutter curtain while the shutter release is depressed.

(2) *Shutter set for 1 to 1/30–second (fig. 1–4).* The speed cam renders the adjusting lever inoperative. The setting cam positions the adjusting guide lever and pivots the slow-speed escapement around its axis. A segment gear is actuated by a catch on the main shutter roller shaft. The slow-speed escapement controls the delay of the second curtain. The slow-speed escapement anchor is deactivated by the disengaging lever at 1/15–second and 1/30–second shutter speeds.

(3) *Shutter speed dial set for 1/50 to 1/1000–second.* At speeds between 1/50–second (electronic flash symbol) and 1/1000–second the slow-speed escapement is disengaged. The speed cam positions the adjusting lever according to the selected speed, and the highest point on the cam (fig. 1–8) sets the shutter for 1/1000–second. The dropping flank, (fig. 1–3) on the main shutter roller shaft, actuates the adjusting lever which rests against the arresting lever "B" eccentric shaft. Figure 1–8 illustrates component positions for 1/1000-second.

c. Shutter Release

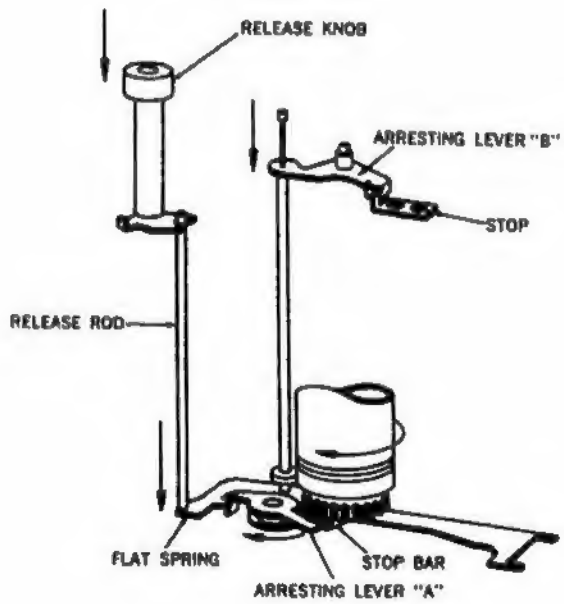

Figure 1–5. Shutter Release, Schematic.

(1) *First shutter curtain* (fig. 1–5). The shutter release knob, when depressed, pushes a release rod against a flat spring. A projection on the flat spring rides against the beveled edge of arresting lever "A", which is spring loaded, and rotates it slightly. The arresting lever sear disengages a bar on the under side of main shutter roller assembly. The shaft of the main shutter roller assembly rotates, and the first shutter curtain runs off. Simultaneously, the second curtain roller of the main shutter roller assembly rotates through a small arc. It is then arrested by arresting lever "B" which engages a catch on the second curtain roller.

(2) *Second shutter curtain.*

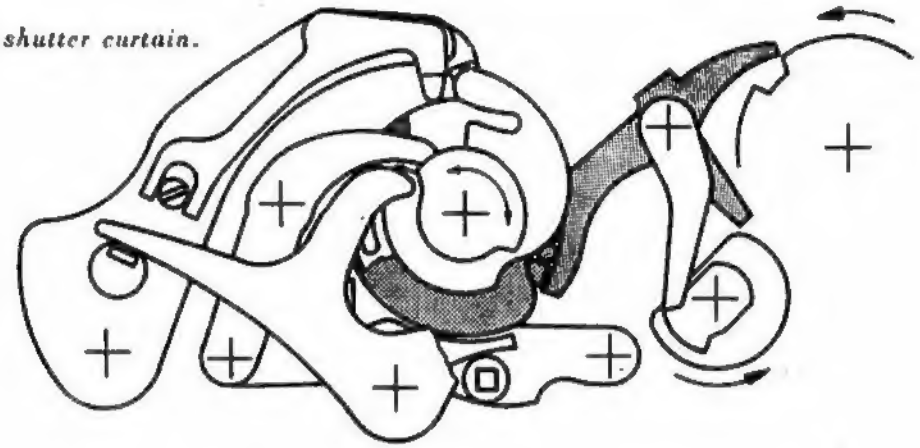

Figure 1–6. Controls in "B" Position, Shutter Released.

(a) B-setting (fig. 1–5, 1–6, 1–7). When the shutter speed dial is set at "B", the speed cam positions the adjusting lever and permits arresting lever "B" to move forward against a stop (fig. 1–5). Depressing the shutter release knob moves the arresting lever down and it engages the second curtain roller catch (fig. 1–7). This prevents run-off of the second curtain. Removing pressure from the shutter release knob returns arresting lever "B" to its upper position, disengaging the catch and permitting rotation of the second curtain roller (fig. 1–6).

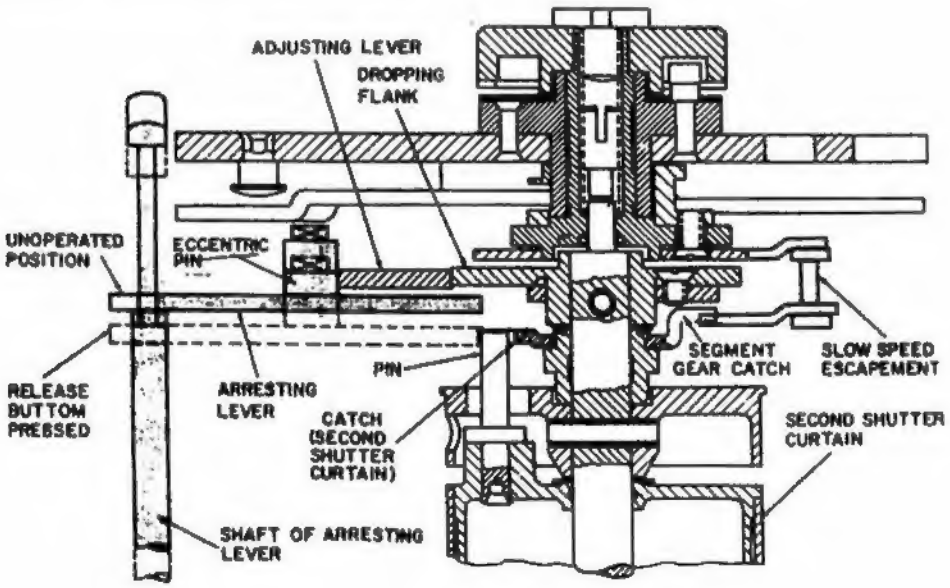

Figure 1–7. Shutter Release, Cross-Section.

(b) 1 to 1/30-second setting. The release of the second curtain, at shutter speeds between 1–second and 1/30–second, is governed by the slow-speed escapement (fig. 1–3). Setting the shutter speed knob rotates the setting cam and pivots the escapement. When set for 1–second the sear of the segment gear engages the segment gear catch of the second curtain roller to its fullest extent. At faster speeds the escapement is pivoted further from the cam axis. A lesser area of the sear engages the catch, and the second curtain is released earlier. Release of the second curtain roller is delayed by the inertia of a gear train and anchor in the slow-speed escapement. With the sear disengaged, the gear train is reset by a hair spring in the escapement.

(c) 1/50 to 1/1000–second setting.

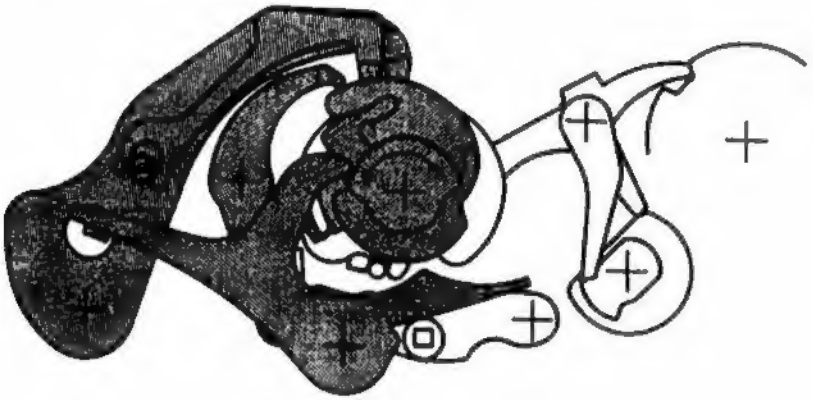

Figure 1–8. Controls in 1/1000-Second Position, Shutter Wound.

At shutter speeds of 1/50–second and faster, the slow-speed escapement is disengaged by the setting cam (fig. 1–8). When the shutter release knob is depressed, the dropping flank (fig. 1–3) rotates and presses the wedge segment of the adjusting lever against the arresting lever eccentric. Arresting lever "B", (fig. 1–5) is pushed back and releases the catch of the second curtain roller (fig. 1–7).

(d) Position for rewinding (fig. 1–3). A pin on top of the second shutter curtain roller rotates when the second curtain is released. Near completion of its run it strikes the opposite end of the lower portion of the double stop lever. This disengages the double stop lever from the notch, on the under side of the driveshaft gear, and releases the stop disc. The shutter can now be rewound.

d. Delayed Action Release (fig. 1–9).

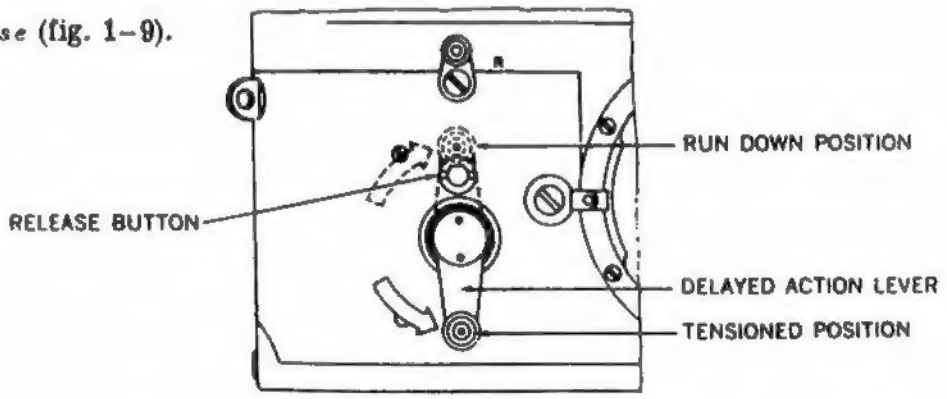

Figure 1–9. Delayed Action Lever and Release.

Delayed shutter release is accomplished by a clockwork mechanism which is spring driven. The spring is wound by a lever on the front of the camera, and the release is activated by depressing a release button.

(1) The wound spring is held under tension by a snap spring. When this is depressed, by the release button, the spring unwinds, activating a gear train and anchor. The winding gear rotates and a cam, on its shaft, moves a rocker arm. The lower part of the arm depresses the flat spring of the shutter mechanism and releases the shutter.

(2) The extent of the delay is governed by the degree to which the spring is wound.

e. Brake Assembly (fig. 37). The brake is deactivated when the shutter is wound. When the shutter is released the first curtain traverses the film aperature and, near the end of its run, activates the brake.

(1) *First curtain braking.* A bar, on the underside of the main shutter roller assembly gear, strikes the lower actuating plate (16) of the brake assembly. This pushes the plate forward and rotates the eccentric brake disc (15) through a small arc pressing it against the brake shoe (3). This gradually slows down the curtain and brings it to a stop.

(2) *Second curtain braking.* Near the end of its run, a pin on the underside of the second shutter curtain roller, strikes the upper actuating plate (12) of the brake assembly and pushes it forward. Friction washers apply partial braking at this point. As the curtain continues its travel the actuating plate (12) is pushed further forward. A notch in the plate engages an upright of the lower actuating plate (16) moving it further forward, and applies additional pressure to the brake disc and shoe.

(3) *Deactivation of brake.* When the shutter is being wound, a cam on the underside of the main shutter roller assembly is rotating. The cam rides against the lower actuating plate (16) and pushes it, with the upper plate, back to the deactivated position.

1–3. Film Transport

a. Film Advance and Take-up (fig. 1–2).

(1) The teeth of the sprocket wheel engage the film perforations and advance the film one frame (8 perforations) for each complete stroke of the winding lever. The driveshaft gear meshes with gear "D" of the take-up spool assembly. Operating the winding lever rotates the take-up spool assembly counter-clockwise and winds the advanced film onto the take-up spool.

(2) The lower end of the double stop lever, (fig. 1–3) stops the drive shaft gear. The upper end of the double stop lever is resting against the stop disc on top of the sprocket wheel assembly and prevents over-advancement of the film. The spring-loaded stop lever, which is on the same axis as the double stop lever, rests against the stop arm and prevents backlash of the sprocket wheel.

(3) The degree of rotation of the take-up spool is dependent on the diameter of the spooled film. As the diameter increases, the take-up spool must rotate to a lesser degree. This is accomplished by a compensating friction clutch (fig. 1–2).

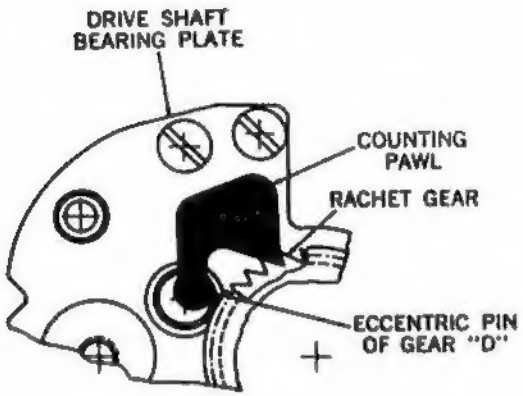

Figure 1–10. Frame Counting Mechanism.

b. Frame Counter (fig. 1–10). The frame counter advances one index each time the winding lever completes a stroke. An eccentric pin on top of gear "D" couples with a pawl. A spring-loaded, flat-headed pin on the under side of the pawl rides in an elliptical slot. The pawl engages a tooth of the frame counter ratchet gear as the eccentric pin rotates.

c. Rewind. After the film has been exposed it is on the take-up spool and must be rewound into the film magazine for removal. This is accomplished by setting the reverse lever to "R", pulling up the rewind knob and turning in the direction of its arrow. Film, while being rewound, is properly tensioned by the take-up spool compensating friction clutch. The rewind knob is disengaged when it is pushed down. This assures smooth transport of the film while winding the shutter.

(1) *Reverse lever.* To rewind exposed film, the sprocket wheel must be disengaged from the winding mechanism so it will rotate freely. The reverse lever when placed in a horizontal position, depresses the coupling disc (fig. 1–2) of the sprocket wheel assembly. This disengages the sprocket wheel.

(2) *Rewind knob assembly* (fig. 21 and 31). The shaft (5) (fig. 31) of the rewind knob assembly has a gear on its lower end. This meshes with an intermediate gear on the bearing plate assembly, which in turn meshes with gear (6) of the rewind fork (7). The intermediate gear rotates the fork in the same direction as the rewind knob. The shaft (5) is held in its bearing by retaining screw (20) (fig. 21). When the rewind knob is pulled up, the key in its shaft engages forked carrier (24). A slotted friction sleeve fits over bearing plate assembly (3) (fig. 31) and rewind knob shaft (22) (fig. 21) fits over sleeve (23). A key, inside the rewind knob shaft, engages the slot in the friction sleeve. The friction of the sleeve prevents counter rotation of the rewind shaft while rewinding the film.

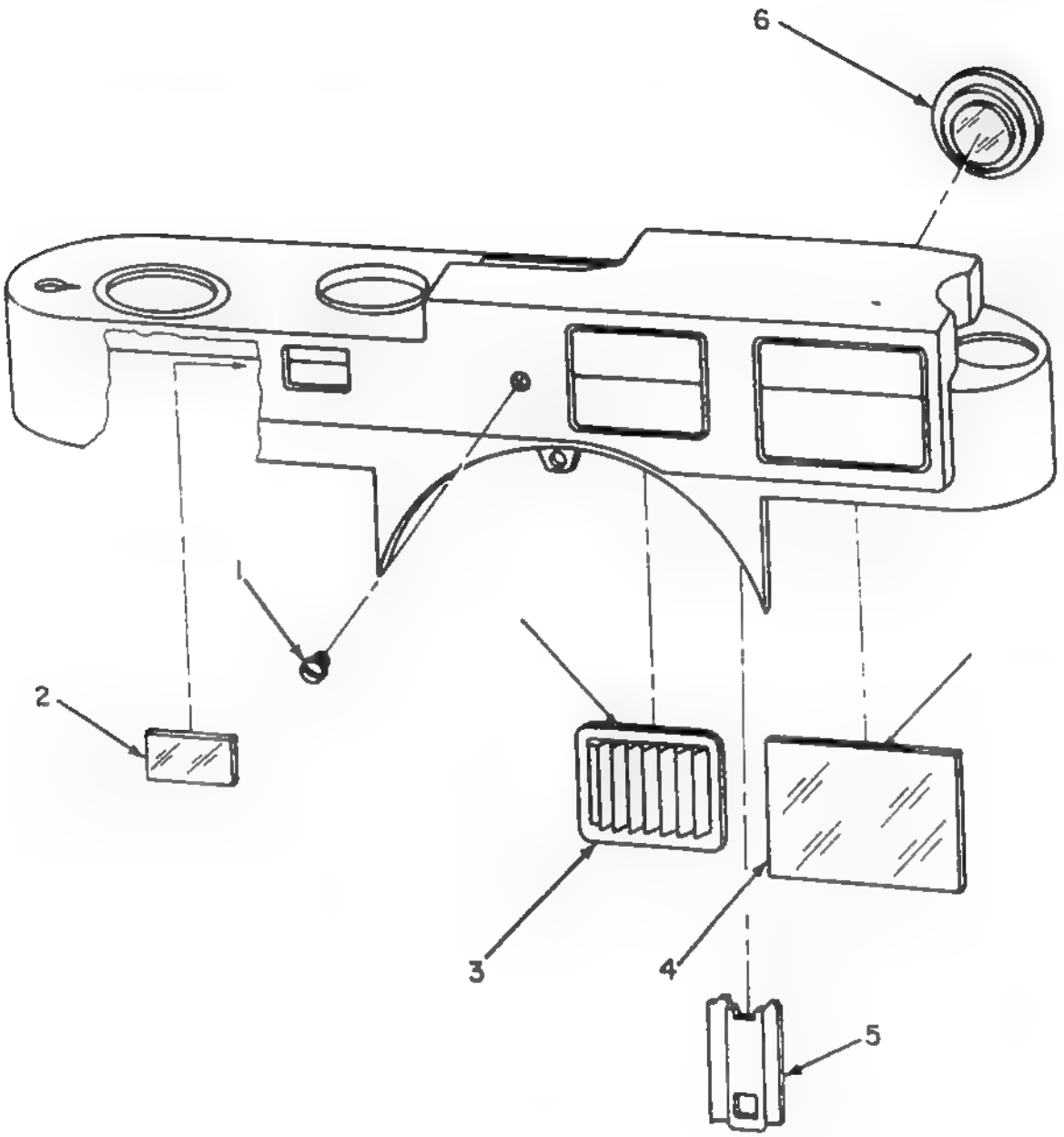

Figure 24. Top Plate Assembly, Exploded View.

Figure 23. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	4 screws	Place small amount on threads	N–T
2	2 angle plates		
3	Pressure plate		
4	Spring		
5	2 screws	Place small amount on threads	N–T
6	Hinged back		
7	Actuator	Place small amount on threads	N–T
8	Locking pin		
9	Spring	Apply lightly all over	F–B
10	2 Plastic cushions	Place small amount on under side	N–T
11	Covering	Place on entire under side	L–T
12	Film type indicator	Place on entire under side	N–T

Figure 24. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Screw		
2	Window	Place around window after seating	K–T
3	Illuminating window	Place around window after seating	K–T
4	Window	Place around window after seating	K–T
5	Holding bracket		
6	Eye lens		

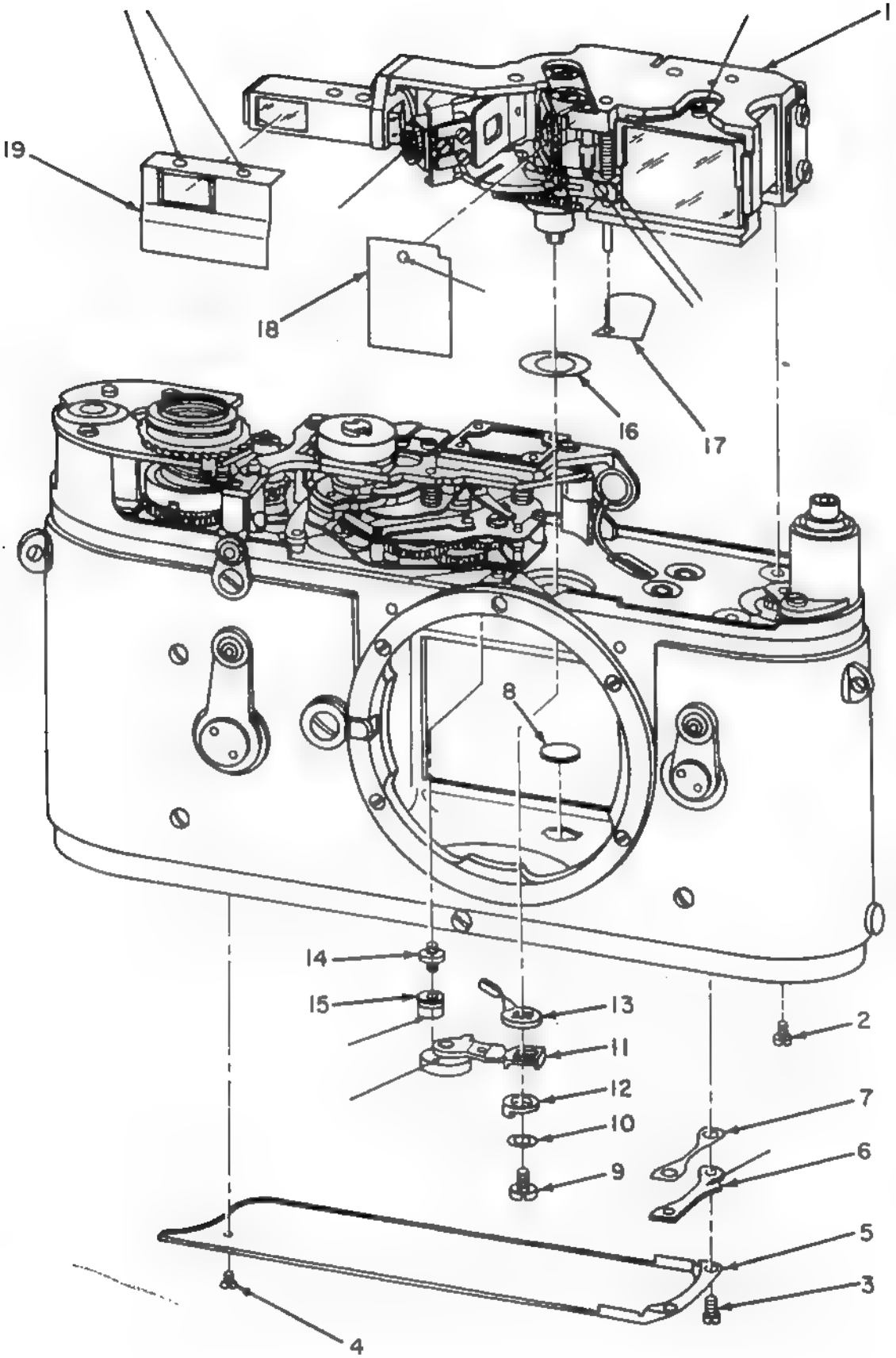

Figure 25. Range-Viewfinder Assembly Removed.

Figure 25. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Range-viewfinder assembly		
2	2 screws	Place small amount on threads	N–T
3	2 screws	Place small amount on threads	N–T
4	Screw	Place small amount on threads	N–T
5	Cover plate		
6	Locking bar		
7	Spacer		
8	Cover plate		
9	Screw		
10	Washer		
11	Roller arm		
12	Cam		
13	Stop arm		
14	Double-end screw	Place small amount on threads of lower end	N–T
15	Eccentric nut		
16	Plastic washer		
17	Plastic plate		
18	Light shield	Place small drop in hole	N–T
19	Light shield	Place small drop in each hole	N–T

Figure 26. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	2 screws		
2	Bright-line frame assembly		
		NOTE: Range-viewfinder is not disassembled beyond removing bright-line frame assembly.	

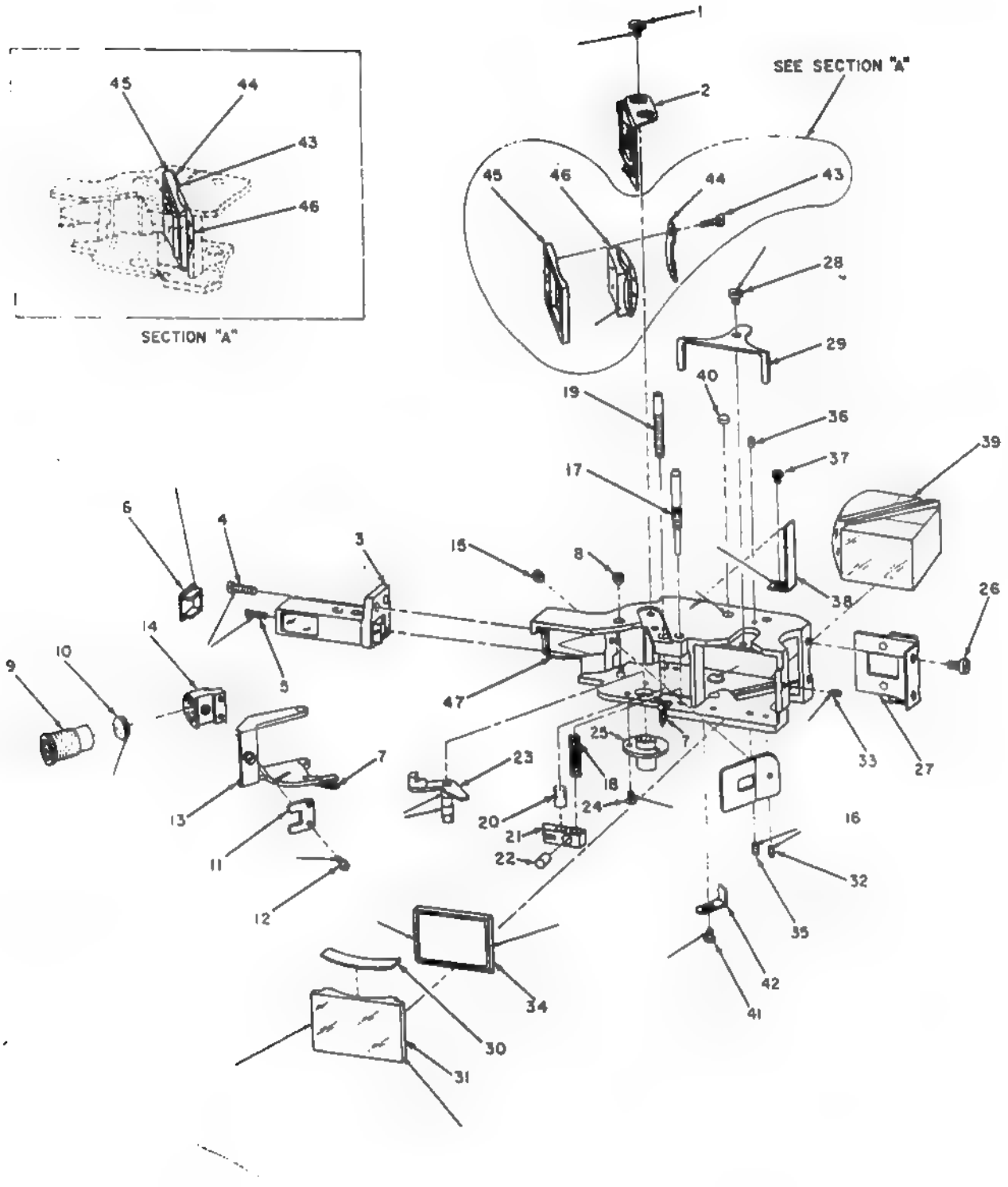

Figure 26. Range-Viewfinder, Exploded View.

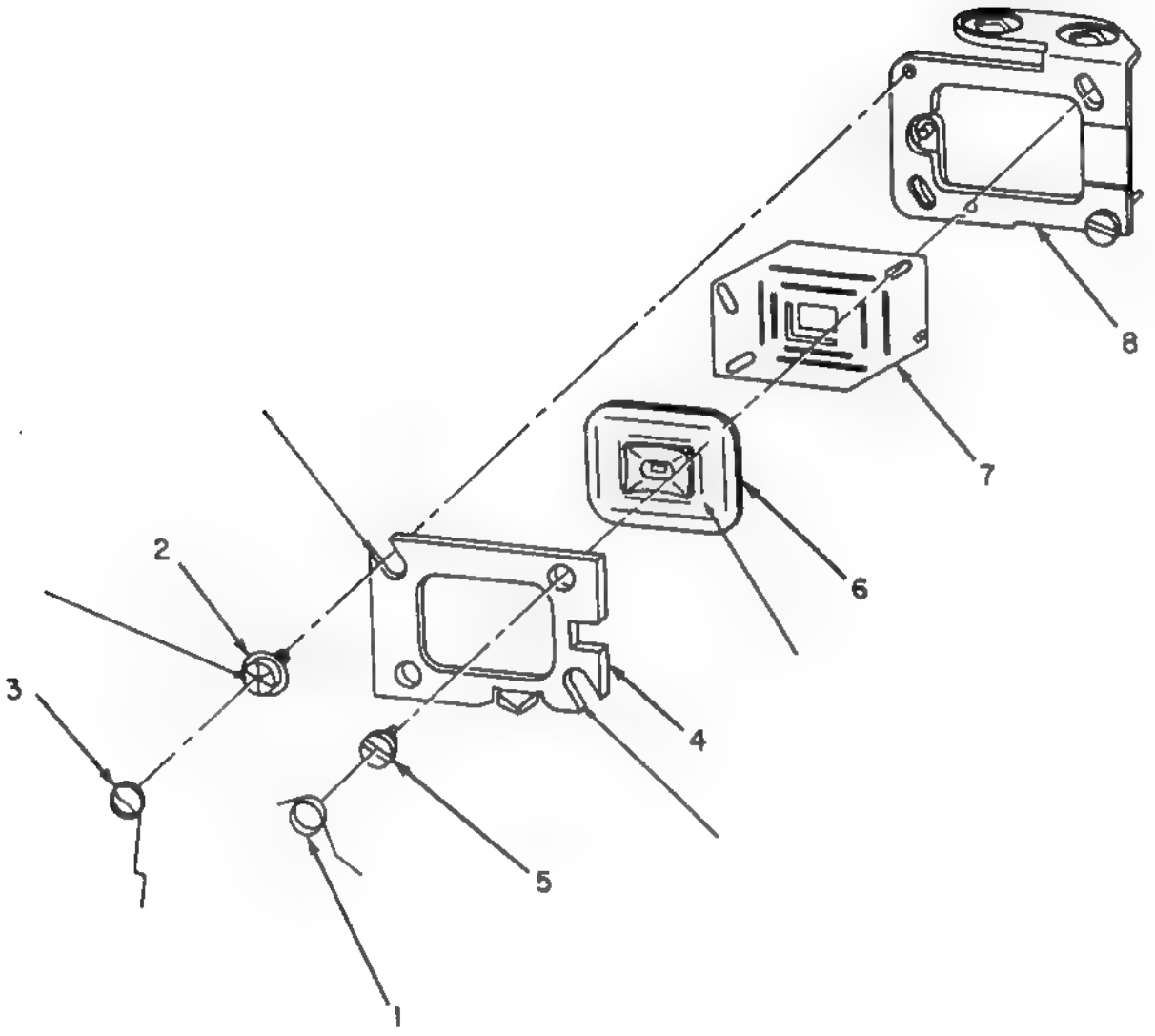

Figure 27. Bright-Line Frame Assembly, Exploded View.

Figure 27. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Spring		
2	Screw		
3	Spring		
4	Glass plate mount	Place small amount in screw guides	E-T
5	Eccentric (riveted)		
6	Glass plate (cemented)	NOTE: Not to be removed	
7	Metal mask		
8	Mask carrier		

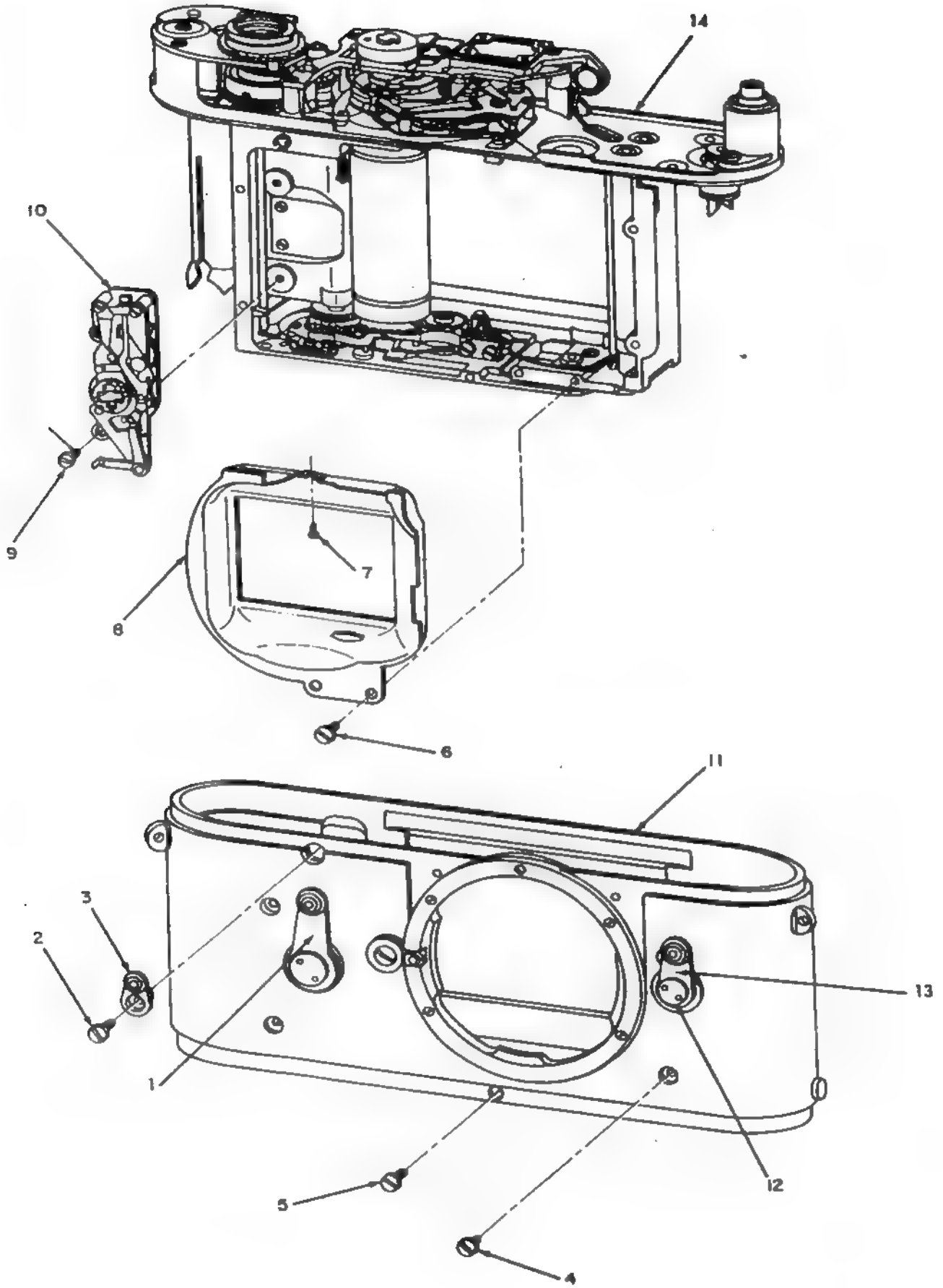

Figure 28. Inner Housing Removed from Outer Housing.

1–6. Range-Viewfinder Assembly

(Fig. 1–11)

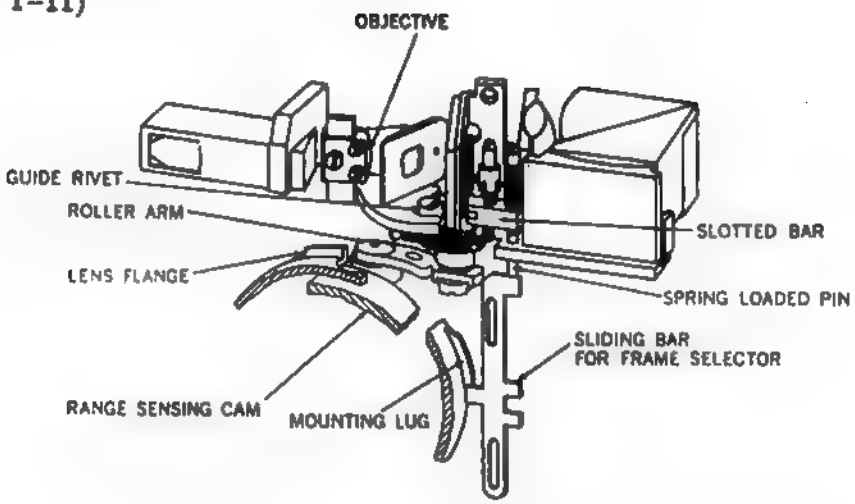

Figure 1–11. Range-Viewfinder, Mechanical Schematic.

The components of the rangefinder and viewfinder are incorporated in one assembly. The magnification factor of the optical system is 0.7. The long base-length (68.5mm) of the rangefinder assures greater accuracy. The rangefinder, through a roller, couples to the focusing cam of the lens focusing mount. The viewfinder indicates the field of view of the 35mm, 50mm and 90mm lenses by bright-line frames which position automatically as the lenses are interchanged.

a. Rangefinder (fig. 1–12)

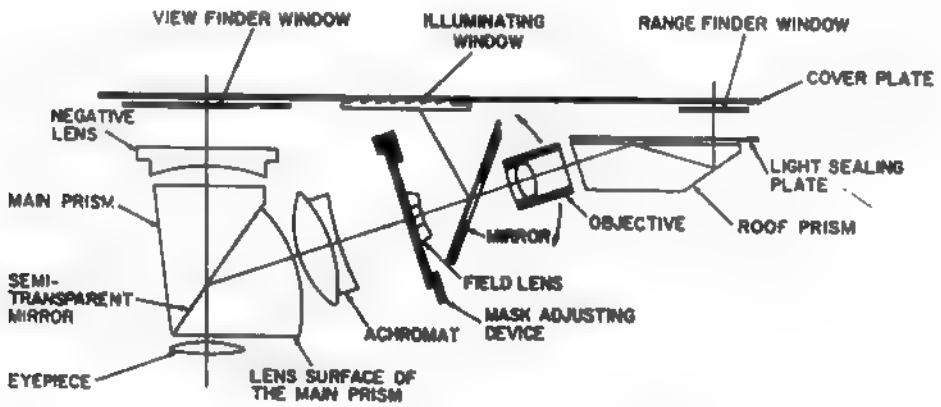

Figure 1–12. Range-Viewfinder, Optical Schematic.

Basically, the rangefinder is optical triangulization of fixed and movable images of the subject being photographed. The fixed image is the viewfinder image, and the movable image is controlled by a swinging objective lens. A cam on the camera lens focusing mount, through the rangefinder roller arm, transmits the focusing movements to the rangefinder objective lens (fig. 1–11). When the two images coincide, the lens is correctly focused.

Figure 28. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Delayed action lever		
2	Screw		
3	Reverse lever		
4	4 screws		
5	Screw		
6	Screw		
7	Screw		
8	Main light shield		
9	Screw		
10	Clockwork mechanism	Place small amount on all bearings	C–S
11	Outer housing		
12	Retaining screw		
13	Frame selector lever		
14	Inner housing		

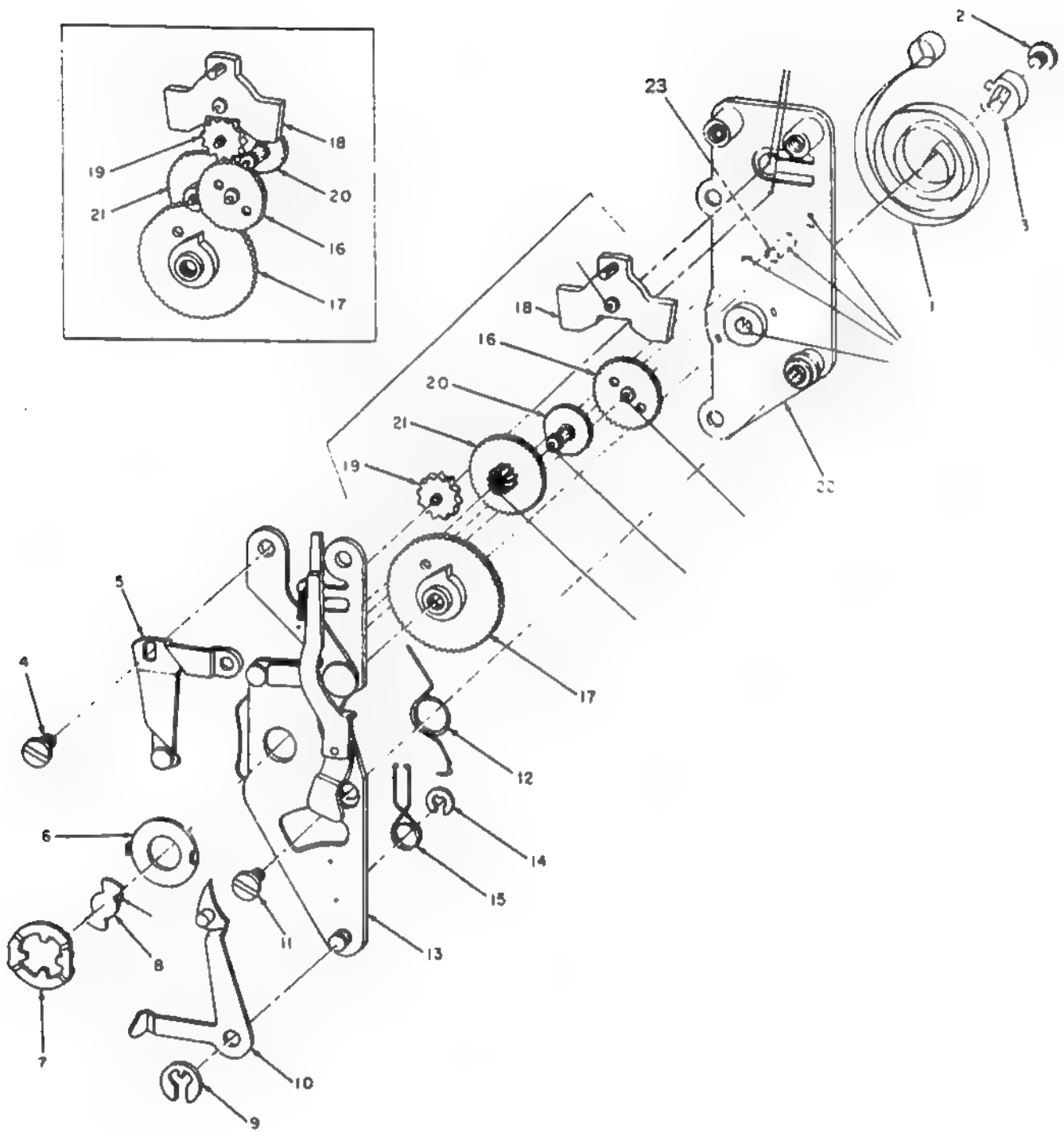

Figure 29. Delayed Action Clockwork, Exploded View.

Figure 29. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Spring	NOTE: Delayed action release clockwork is not dis-assembled beyond removing spring.	
3	Spring carrier		
7	Winding disc		
23	Stud		

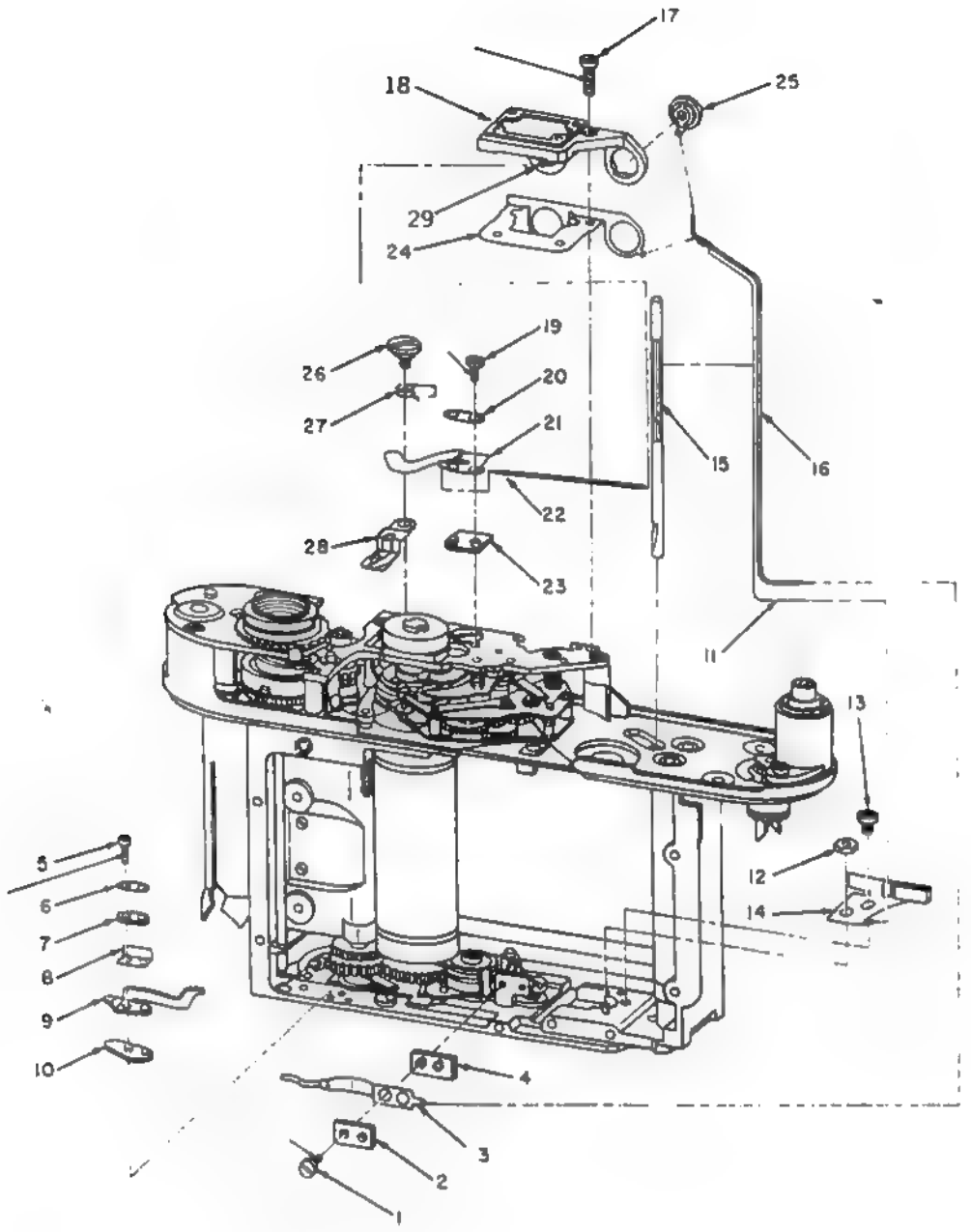

Figure 30. Synchronizing Components, Exploded View.

Figure 30. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	2 screws		
2	Insulating plate		
3	Long contact spring	Apply on each side to cement insulating plates	N–T
4	Insulating plate		
5	2 screws		
6	Metal plate		
7	Insulating plate	Apply on under side	N–T
8	Insulating shield	Apply on under side	N–T
9	Short contact spring	Apply on under side	N–T
10	Insulating plate		
11	Ground wire		
12	Nut		
13	Screw		
14	Guide spring	Apply lightly inside spring clip	E–B*
15	Metal tube		
16	Insulated wire		
17	Screw	Place small amount on threads	N–T
18	Terminal frame		
19	2 screws		
20	Insulating plate		
21	Contact spring	Apply on each side to cement insulating plates	N–T
22	Insulated wire		
23	Insulating plate		
24	Grounding plate		
25	Terminal		
26	Screw		
27	Spring		
28	Synchro adjusting lever		
29	Terminal		

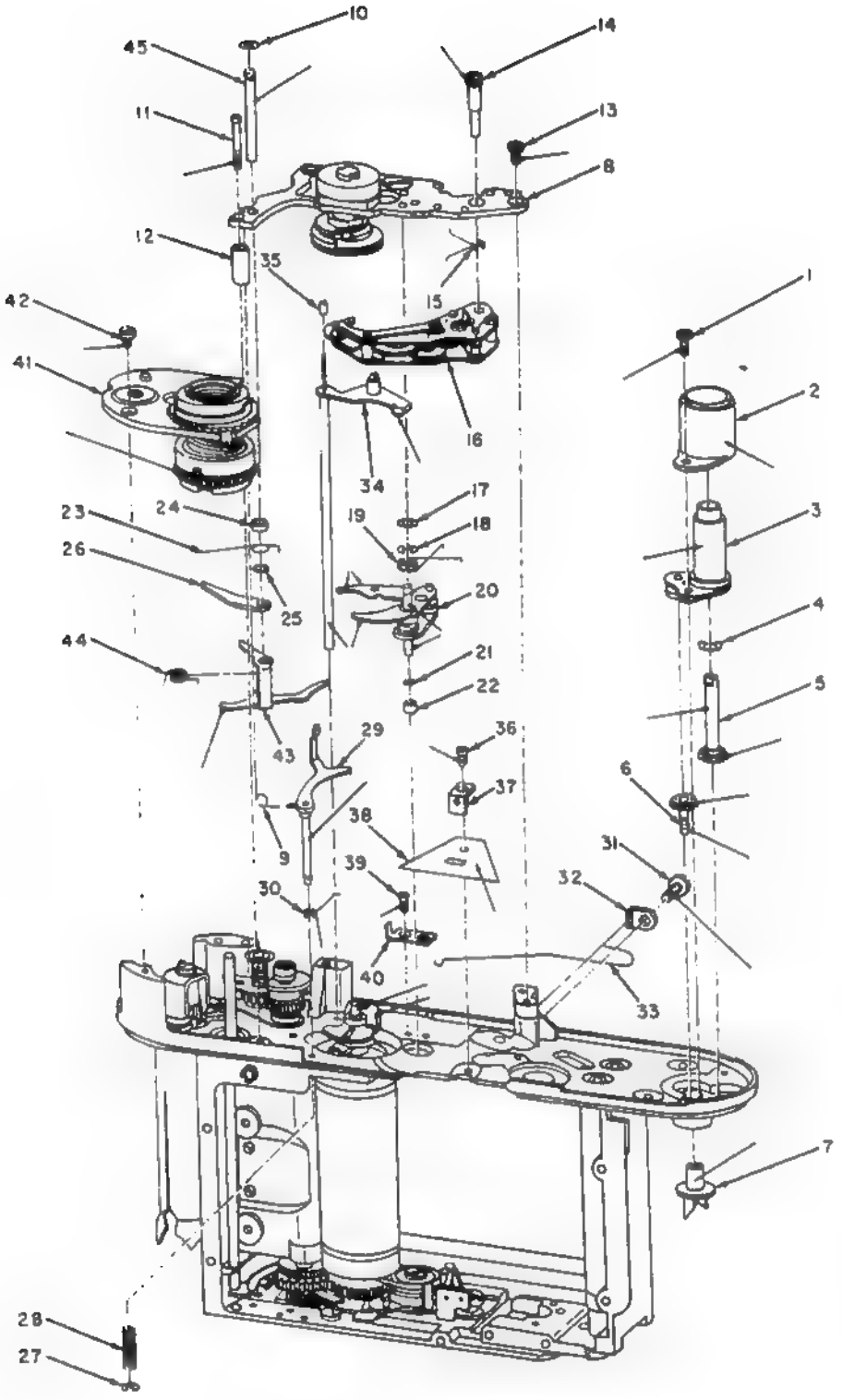

Figure 31. Bearing Plate, Drive Shaft and Rewind Assembly, Partial Exploded View.

Figure 31. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	2 screws	Place small amount on threads	N–T
2	Sleeve		
3	Assembly	Apply lightly on outside of shaft	A–F
4	Washer		
5	Rewind shaft	Apply lightly on shaft	B–B
6	Gear	Apply lightly on teeth	F–B
		Place small amount on threads	N–T
7	Rewind fork	Place small amount on shaft	B–B
8	Shutter bearing plate assembly		
9	Ground wire		
10	"C" clip		
11	Long screw	Place small amount on threads	N–T
12	Sleeve		
13	2 screws	Place small amount on threads	N–T
14	Threaded shaft	Place small amount on threads	N–T
		Apply lightly on shaft	F–B
15	Spring		
16	Slow speed escapement	Apply lightly to all bearings	C–S
17	Washer		
18	"C" clip		
19	Spring		
20	Adjusting lever assembly	Apply lightly on upper and lower shaft and noses of levers	F–B
		Apply lightly on lever bearing	C–S
21	Washer		
22	Spacer sleeve		
23	Spring		
24	Spacer ring		
25	Washer		
26	Stop lever		
27	"C" clip		
28	Spring		
29	Contact arm	Apply lightly to shaft and nose of arm	E–B
30	Spring		
31	Screw	Place small amount on threads	N–T
32	Holding plate		
33	Spring		
34	Arresting lever "B"	Apply lightly on shaft, eccentric and nose of lever	F–B

(Continued on next page)

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
35	Insulating cap		
36	Screw	Place small amount on threads	N–T
37	Angle bracket		
38	Light shield	Self-adhesive	
39	2 screws	Place small amount on threads	N–T
40	Stop plate		
41	Drive shaft assembly		
42	3 screws	Place small amount on threads	N–T
43	Double stop lever	Apply lightly on all noses	F–B
44	Spring		
45	Shaft		

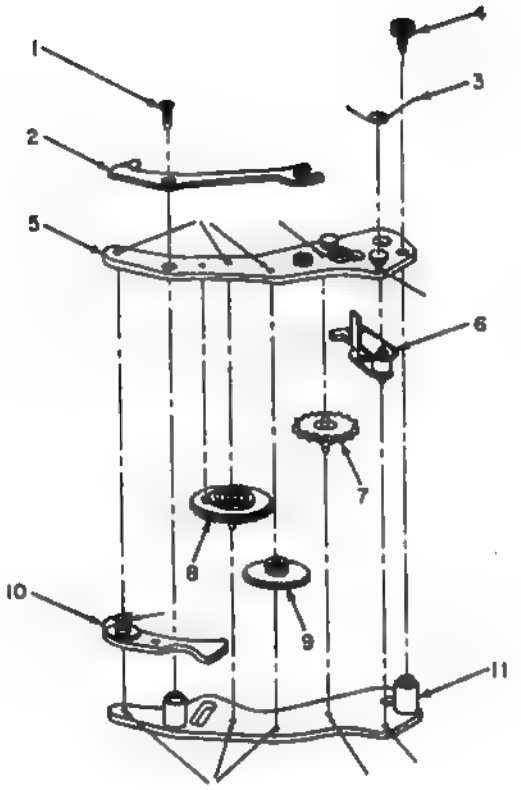

Figure 32. Slow-Speed Escapement, Exploded View.

Figure 32. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Screw	NOTE: Slow speed escapement	
2	Guide lever	not to be disassembled.	
3	Spring		
4	Screw		
5	Upper mounting plate	See Paragraph 4–8*b*(3)	
6	Anchor Assembly		
7	Dog gear		
8	Gear with Spiral Spring		
9	Double gear		
10	Segment gear Assembly		
11	Lower mounting plate		

(1) *Optical system.* Rays from the subject enter the fixed roof prism and are inverted. They pass through the objective lens, the mirror aperture, and an opening in the field lens, and are focused in the plane of the bright-line frames. An opening in the center of the metal mask permit formation of an aerial image. The image is viewed through the eyelens, and combines with the viewfinder image in the beam-splitting prism.

(2) *Mechanical functioning* (fig. 1–11, 26). As the lens focusing mount is rotated, a cam am on its rear surface, actuates the rangefinder roller arm. A cam on the upper part of the roller arm axel (23) fig. 26 moves the objective lever assembly through an arc. The swing of the objective lens changes the angle between the images. The objective lever assembly is spring loaded and mounted on ball bearing pivots (8).

b. Viewfinder (fig. 1–12). The viewfinder system consists of an eyelens, main prism with semi-transparent mirror, and a negative lens. A parallax-adjusting bright-line frame assembly outlines the field of various lenses. Disassociated optically, but coupled mechanically, is a frame selector (fig. 1–11) permitting preview of the fields covered by the 35mm, 50mm and 90mm lenses.

(1) *Optical system* (fig. 1–12).

(a) Subject viewing. The viewfinder, not considering the bright-line frame portion, has a simple optical system. Rays from the subject area enter a negative lens, pass through the beam-splitting prism and are imaged by the positive eye lens.

(b) Bright-line frames. The bright-line frame is imaged in the viewfinder by an optical system collimated for infinity. The optical components are an eye-lens, beam-splitting prism-lens combination, an achromatic lens, a field lens, a metal mirror with central aperture, and an illuminating window. Light, falling on the illuminating window, is directed by its prismatic surface to the mirror which is mounted at an angle. The mirror reflects the light to the bright-line frame assembly. The field lens, cemented on the glass plate, directs light to the smaller (90mm) bright-line frame. The achromatic lens, in combination with the lens surface of the beam-splitting prism, images the bright-line frame and directs it to the semi-transparent surface of the beam-splitter. The rays combine with the viewfinder image and are reflected to the eyelens.

(2) *Mechanical functioning* (fig. 1–11, 27).

(a) Bright-line frame assembly. The bright-line frames are contained between two cemented glass plates. The frame, corresponding to the lens mounted on the camera, is displayed in the viewfinder by the metal mask (7), fig. 27 which slides across the glass plate. The mask is actuated over a sliding bar (fig. 1–11), by one of the mounting lugs on the camera lens.

(b) Parallax compensation. Parallax is automatically adjusted as the lens is focused. The range-finder roller arm, when moved by the range sensing cam of the lens, also moves a wedged guide rivet which is attached to the roller arm axel. This moves the metal mask and glass plate diagonally across the field.

(c) Frame selector. Fields covered by the different focal length lenses may also be displayed in the viewfinder by operating a frame selector on the front of the camera. The frame selector moves a bar (fig. 1–11) which actuates a spring-loaded pin. The pin, through a slotted bar and lever arrangement, moves the metal mask across the glass plate. When the selector is pushed toward the camera lens the 90mm frame shows in the viewfinder, and when pushed away from the lens the 35mm frame is shown. The 50mm frame is positioned when the frame selector lever is in the vertical position.

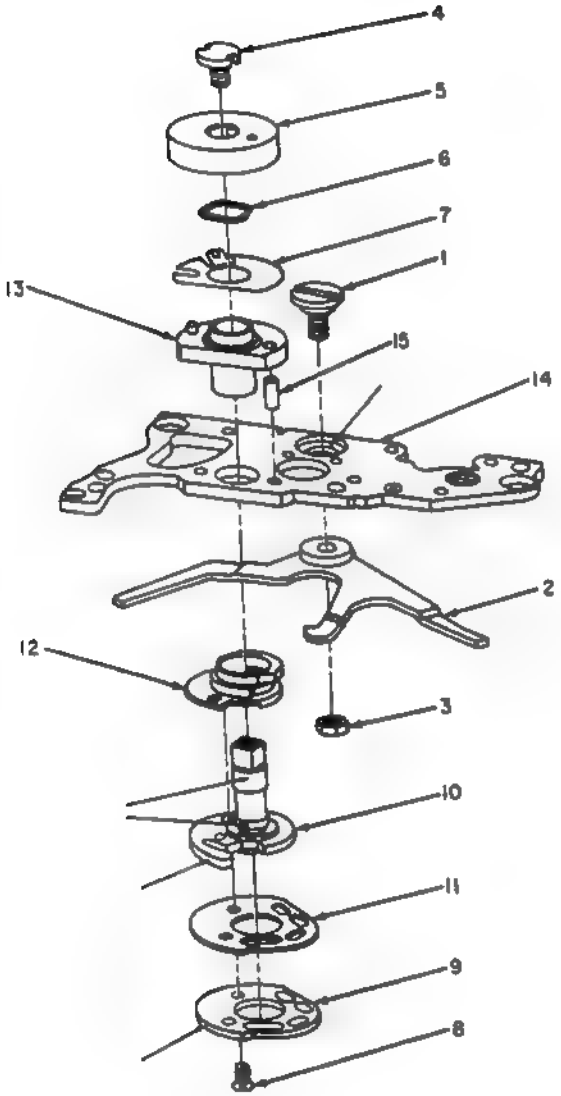

Figure 33. Bearing Plate Assembly, Exploded View.

Figure 33. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Screw	NOTE: Bearing plate assembly not to be disassembled completely.	N–T
2	Disengaging lever		
3	Nut		
4	Screw		
5	Speed dial knob		
6	Spring washer		
7	Arresting spring		
8	Screw		
9	Slow speed cam		D–B
10	High speed cam		D–B
11	Spacer		
12	Synchro lever setting cam		
13	High speed cam bearing		
14	Bearing plate		
15	Rivet		

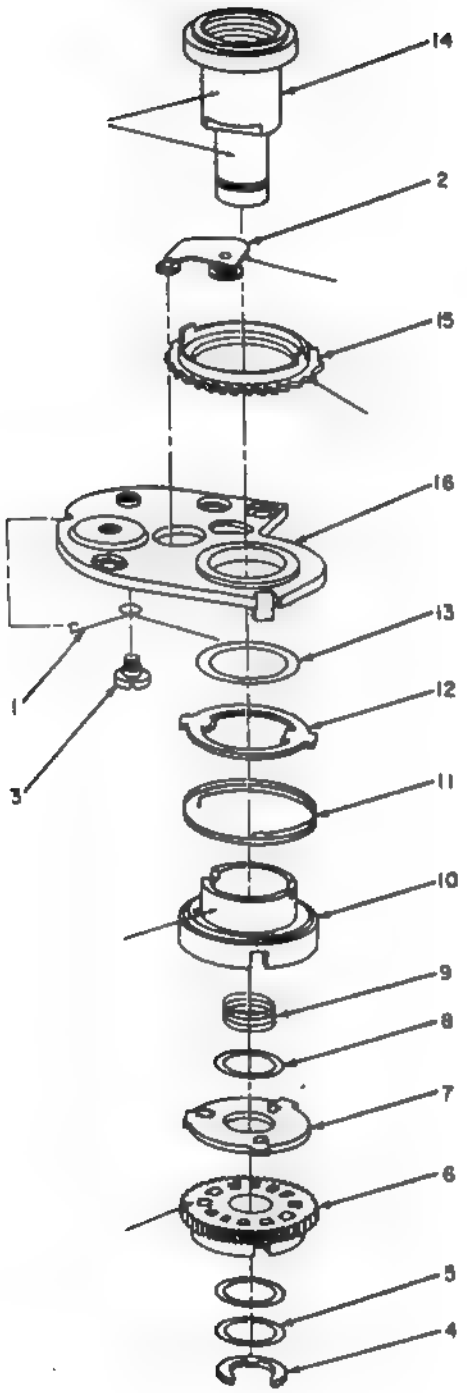

Figure 34. Drive Shaft Assembly, Exploded View.

Figure 34. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Spring		
2	Pawl	Apply lightly on under side	F–B
3	Screw	Place small amount on threads	N–T
4	"C" clip		
5	Washer		
6	Driveshaft gear		
7	Ratchet plate		
8	Washer		
9	Spring		
10	Carrier sleeve	Apply lightly on inside and top	D–B
11	Spring		
12	Carrier disc	Apply lightly on both sides	D–B
13	Washer		
14	Drive shaft	Apply lightly on outside of shaft	B–B
15	Ratchet gear	Apply lightly all over	B–B
16	Driveshaft bearing plate		

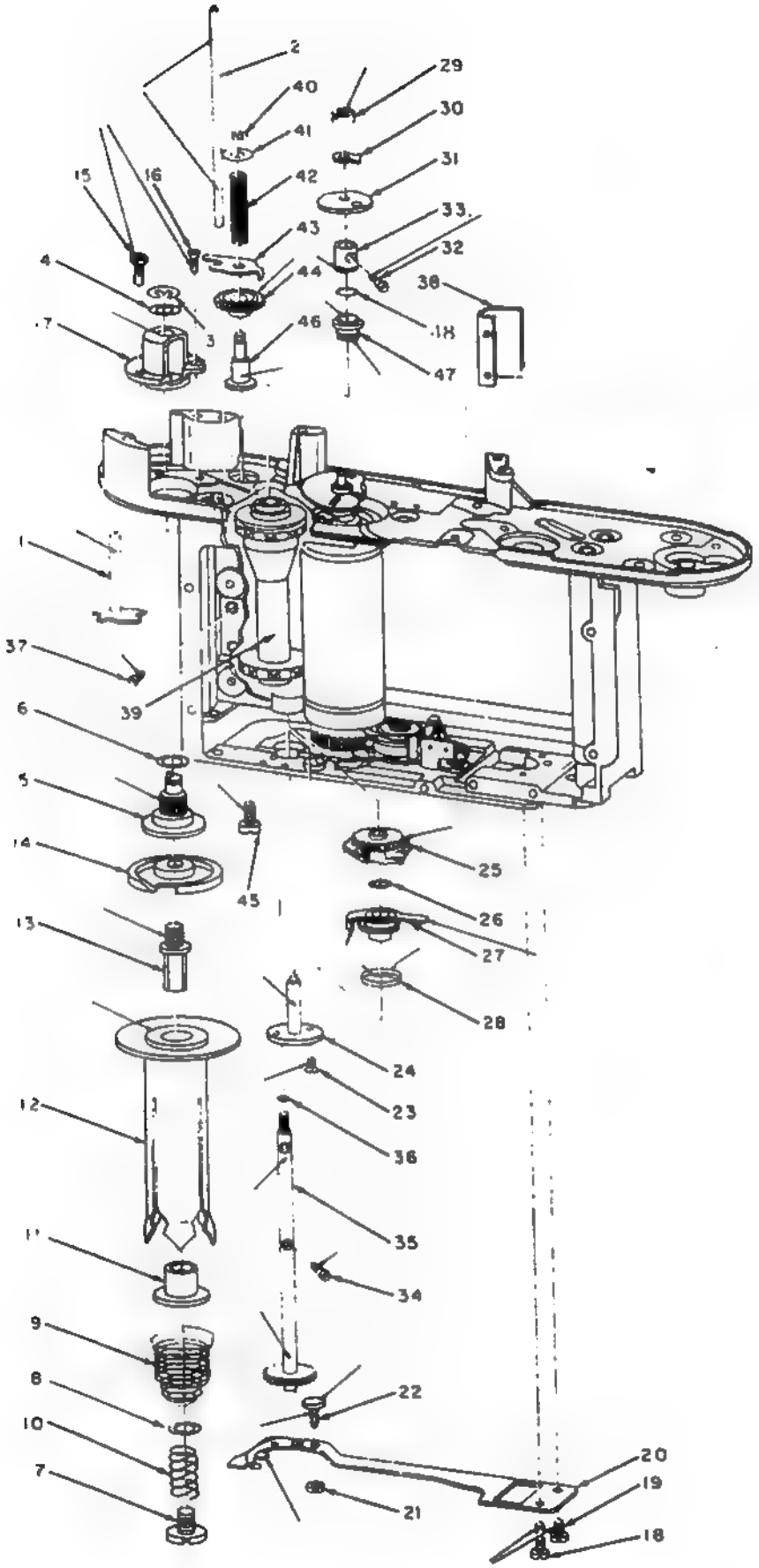

Figure 35. Take-up, Film Transport and Release Mechanism, Partial Exploded View.

Figure 35. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Release shaft	Apply lightly on shaft	F–B
2	Release rod	Apply lightly on upper and lower ends	F–B
3	"C" clip		
4	Washer		
5	Gear	Apply lightly on upper shaft, eccentric and gear teeth	F–B
6	Washer		
7	Screw		
8	Washer		
9	Spring		
10	Spring	Wipe on lightly	F–B
11	Bushing	Apply lightly on shaft and top of flange	F–B
12	Take-up spool	Apply lightly on top of flange	F–B
13	Holding shaft	Place small amount on threads	N–T
14	Release disc		
15	2 screws	Place small amount on threads	N–T
16	Screw	Place small amount on threads	N–T
17	Bearing		
18	Long screw	Place small amount on threads	N–T
19	Short screw	Place small amount on threads	N–T
20	Flat spring		
21	Nut		
22	Adjusting screw	Place small amount on threads	N–T
23	2 screws	Place small amount on threads	N–T
24	Intermediate gear shaft	Apply lightly on shaft	F–B
25	Intermediate gear		
26	Washer		
27	Arresting lever "A"	Apply lightly on both noses	F–B
28	Spring		
29	Retaining nut	Place small amount inside threads	N–T
30	Stop arm		
31	Stop disc		
32	Screw	Place small amount on threads	N–T
33	Gear	Place small amount on gear teeth	F–B
34	Screw	Place small amount on threads	N–T
35	Shaft	Apply small amount on upper and lower ends of shaft	F–B
36	Washer		
37	2 screws	Place small amount on threads	N–T

(Continued on next page)

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
38	Curved bracket plate		
39	Sprocket wheel		
40	"C" clip		
41	Washer		
42	Spring		
43	Locking lever		
44	Intermediate gear	Place small amount on top	E–B
45	Screw	Place small amount on threads	N–T
46	Shaft	Apply lightly on lower part of shaft	F–B
47	Bearing	Place small amounts on threads	N–T
48	Washer		

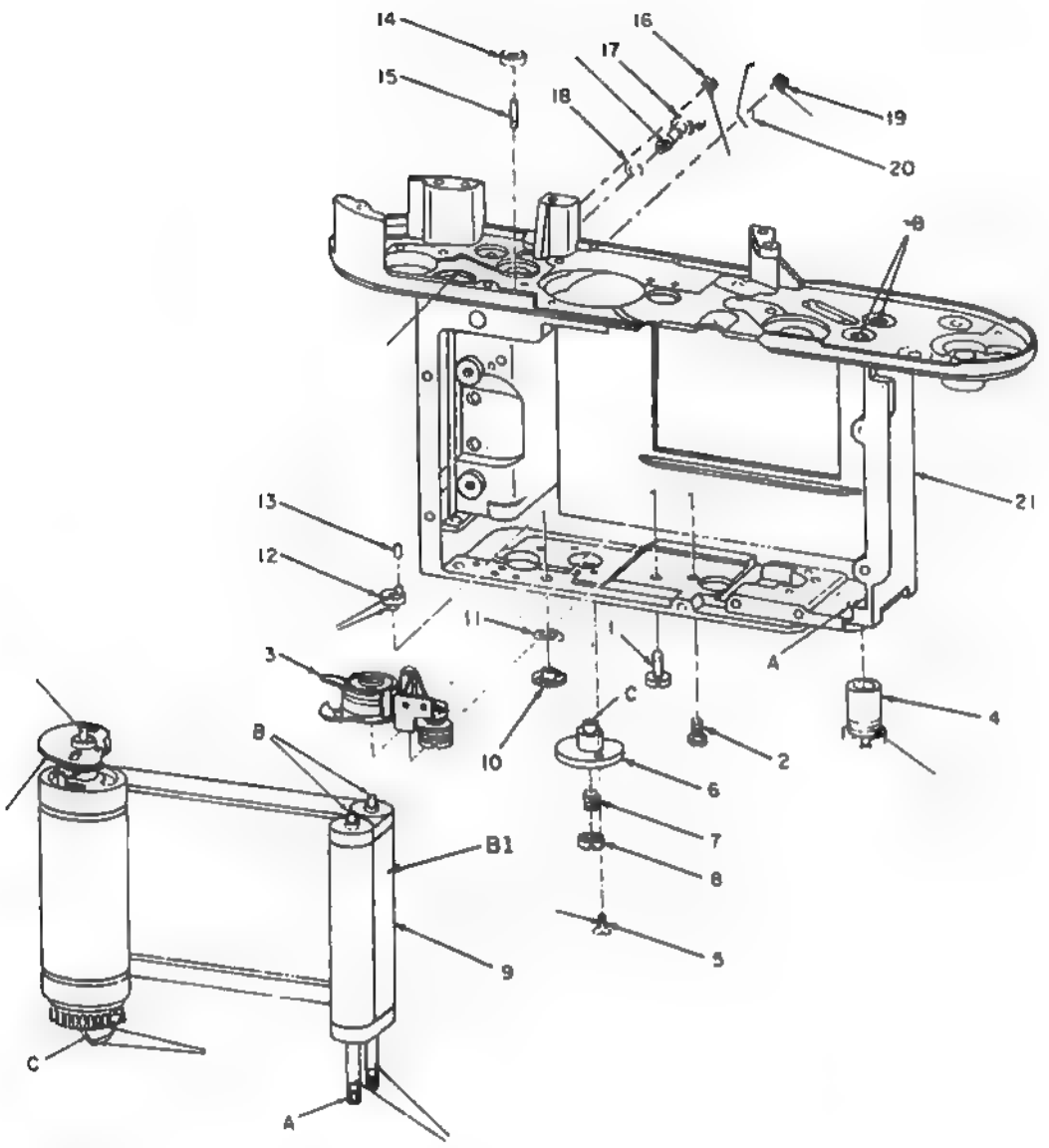

Figure 36. Shutter and Brake Assemblies Removed.

Figure 36. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Long screw	Place small amount on threads	N–T
2	Short screw	Place small amount on threads	N–T
3	Brake assembly		
4	2 Shutter tension adjusting bearings	Place small amount on threads	N–T
5	2 screws	Place small amount on threads	N–T
6	Bearing		
7	Adjusting screw		
8	Nut		
9	Shutter curtain assembly		
10	Nut	Place small amount inside threads	N–T
11	Spring washer		
12	Eccentric	Place small amount on under side	F–B
13	Insulating cap	Place small amount inside	N–T
14	Nut		
15	Adjusting screw	Place small amount on threads	N–T
16	Stop screw		
17	Camshaft	Apply small amount on shaft bearing surface	E–B
18	Washer		
19	Screw		
20	Camshaft spring		
21	Inner housing		

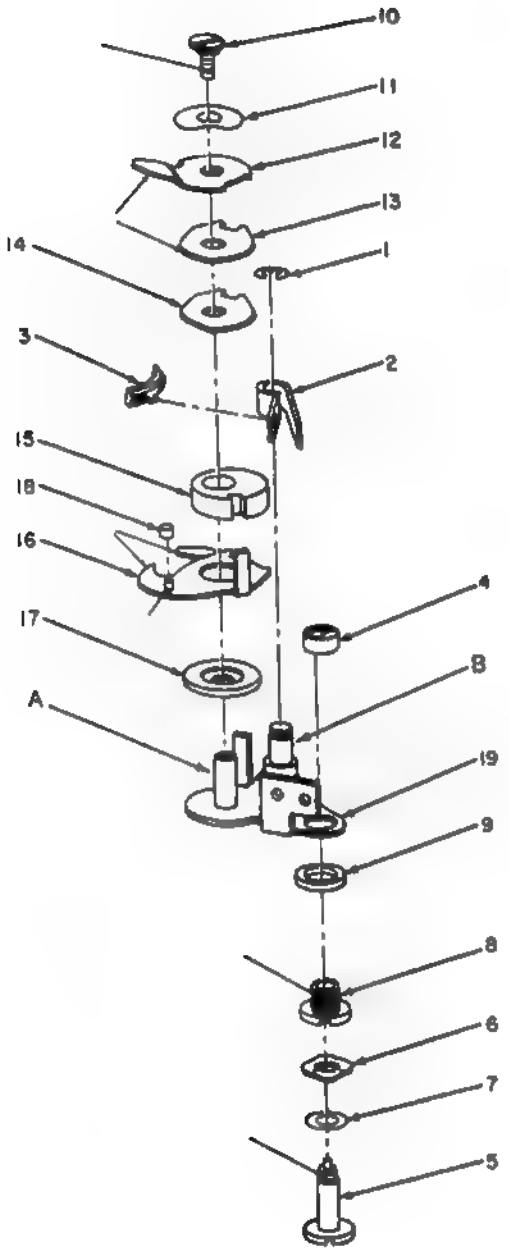

Figure 37. Brake Assembly, Exploded View.

1–5. Synchronization

The camera has two synchronizing circuits; one with adjustable delay for flash bulbs, and one without delay for electronic flash. A precontact switch for each circuit is interconnected with the shutter release. During a portion of the camera winding cycle the synchronizing contacts are closed, but the precontact switches are closed only when the shutter release knob is depressed, and premature firing is prevented. The synchronizing circuits, one side of which is grounded, terminate in synchro outlet plugs on the rear of the camera top plate. The flash bulb outlet is identified by a bulb symbol, and the electronic flash outlet by a lightning stroke symbol.

a. Flash Bulbs. Flash bulbs require a period of time between ignition and usable light output. To provide this delay the synchronizing circuit must be closed before the first shutter curtain has started to uncover the film aperture. The delay between closing of the circuit, and the entry of the first curtain into the film aperture, must be varied in accordance with the shutter speed selected.

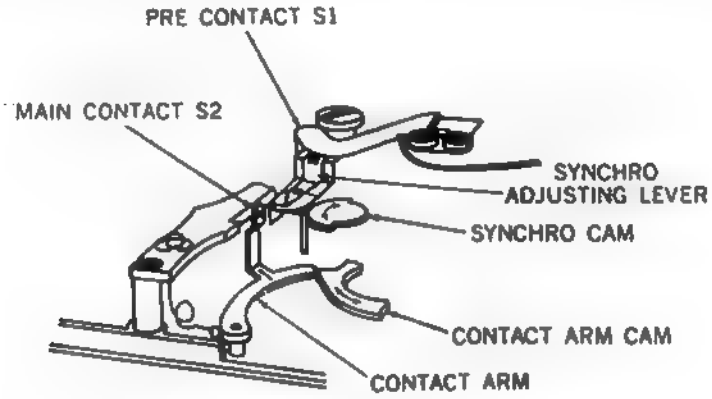

Figure 1–13. Flash Bulb Circuit, Contacts Open.

(1) *Delay mechanism* (fig. 1–13). A synchro cam, on the shaft of the speed cam, positions the synchro adjusting lever. The cam brings the lever closer to, or further from, the contact arm as the shutter speed dial is adjusted.

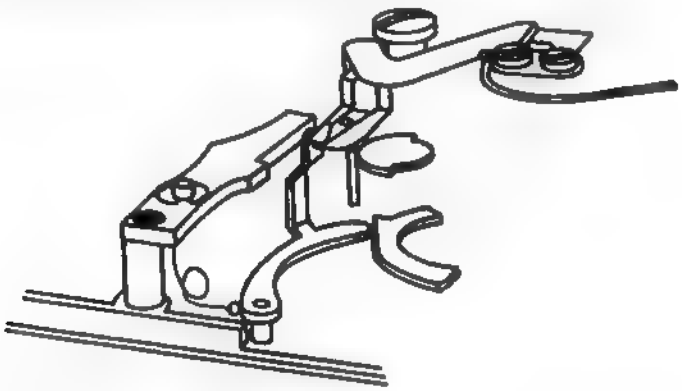

Figure 1–14. Flash Bulb Circuit, Contacts Closed.

(2) *Bulb circuit.* The contact arm cam (fig. 1–14) on the main shutter roller assembly, rotates when the shutter release knob is depressed. Rotation of the cam moves the spring-loaded contact arm toward the synchro adjusting lever and closes the circuit. When the first shutter curtain has traversed the film aperture, the high point of the contact arm cam is resting against the contact arm. This moves the arm away from the synchro adjusting lever and opens the circuit.

Figure 37. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	"C" clip		
2	Spring		
3	Brake shoe		
4	Eccentric nut	Place small amount on inside threads	N–T
5	Shaft		
6	Spring washer		
7	Washer		
8	Bushing	Place small amount on threads	N–T
9	Spacer		
10	Screw		
11	Spring washer		
12	Upper actuating plate	Place small amount on nose contacting surface	F–B
13	Friction washer	Apply small amount on top	F–B
14	Friction washer		
15	Brake disc		
16	Lower actuating plate	Apply small amount on inside of noses	F–B
17	Friction washer		
18	Insulating cap	Place small amount on inside	N–T
19	Bearing plate		

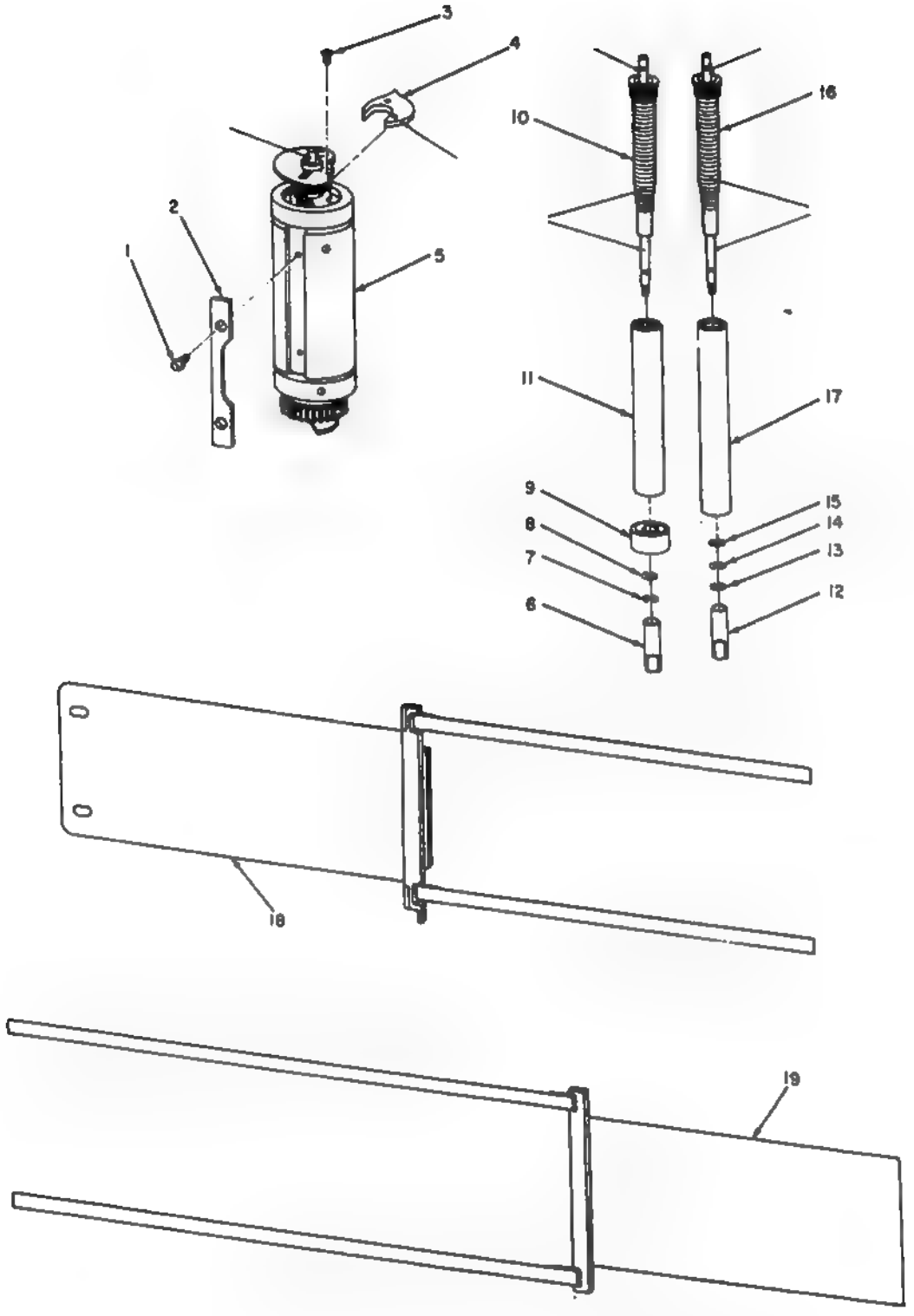

Figure 38. Shutter Curtain Assembly, Exploded View.

Figure 38. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	2 screws	Place small amount on threads	N–T
2	Holding bar		
3	2 screws	Place small amount on threads	N–T
4	Contact arm cam	Place small amount on outside edges	F–B
5	Second shutter curtain roller	Place small amount on inside bearing surfaces	C–S
6	Tensioning stud	Place small amount on inside threads	N–T
7	2 "C" clips		
8	2 washers		
9	2 ribbon guide rollers		
10	Spring roller shaft assembly	Wipe in between spring coils	E–F
		Apply lightly to shaft bearing surfaces	E–B
11	Spring roller	Place small amount on inside threads	N–T
12	Tensioning stud	Place small amount on inside threads	N–T
13	Washer		
14	"C" clip		
15	Washer		
16	Spring roller shaft assembly	Wipe in between spring coils	E–F
		Apply lightly to shaft bearing surfaces	E–B
17	Ribbon spring roller	Place small amount on inside threads	N–T
18	Second shutter curtain and ribbons	Apply to inner surface, for approximately 3/4–inch, on free ends of ribbons	J–T
19	First shutter curtain and ribbons	Apply to fabric surface, for approximately 3/4–inch, on free end of curtain	J–T
		Apply to inner surface, for approximately 1–inch, on free ends of ribbons	J–T

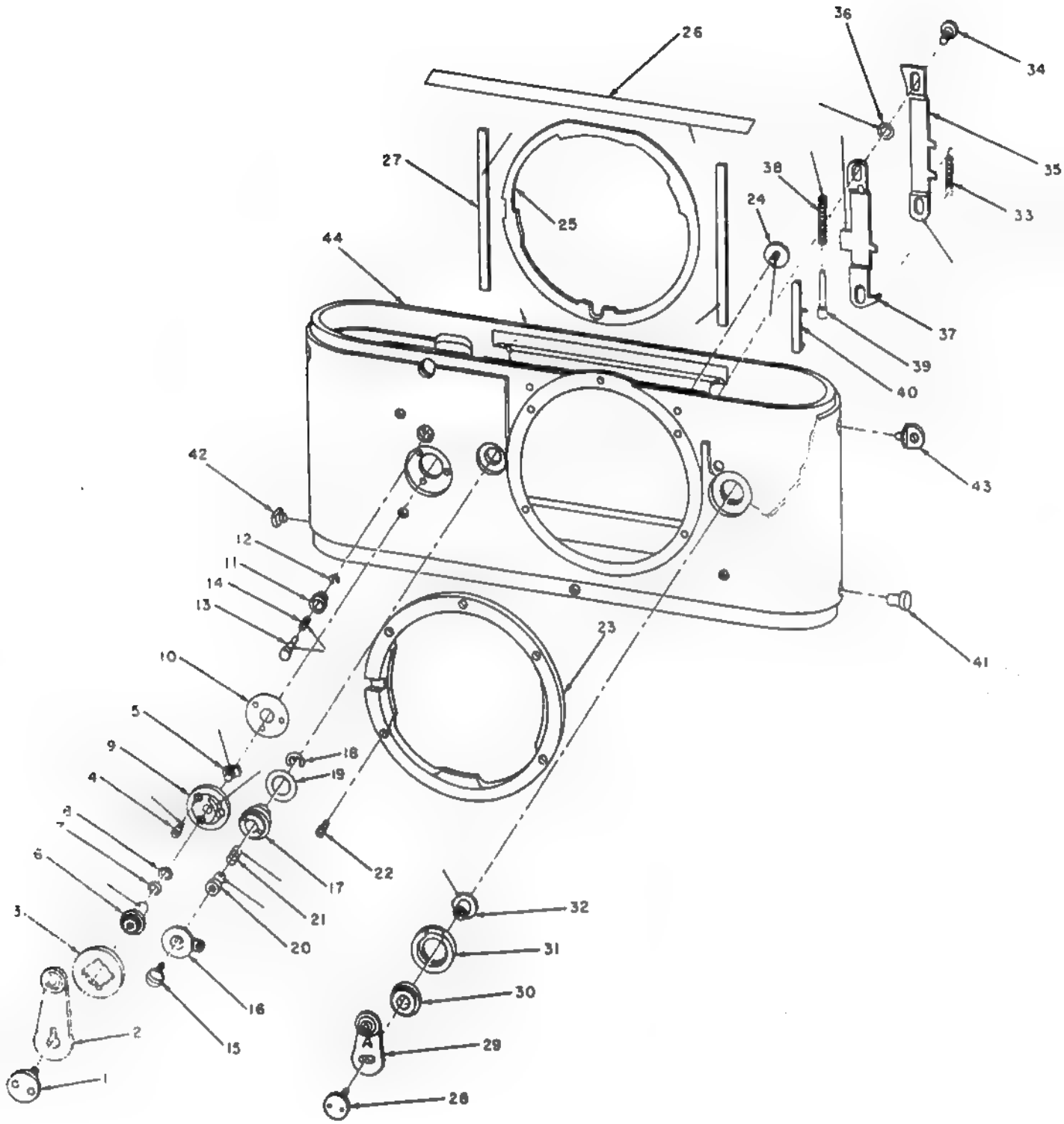

Figure 39. Outer Housing, Exploded View.

Figure 39. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
15	Screw		
16	Lens lock		
22	4 screws		
23	Lens mounting flange		
24	4 screws		
25	Spring ring	Apply lightly to 4 high points on rear	E–B
26	Light sealing strip	Apply small amount to rubberized surface, for approximately 1/16–inch, along edge	I–T
27	Felt strips	Apply to one surface NOTE: Outer housing is not usually disassembled completely	I–T
43	2 Eyelets		

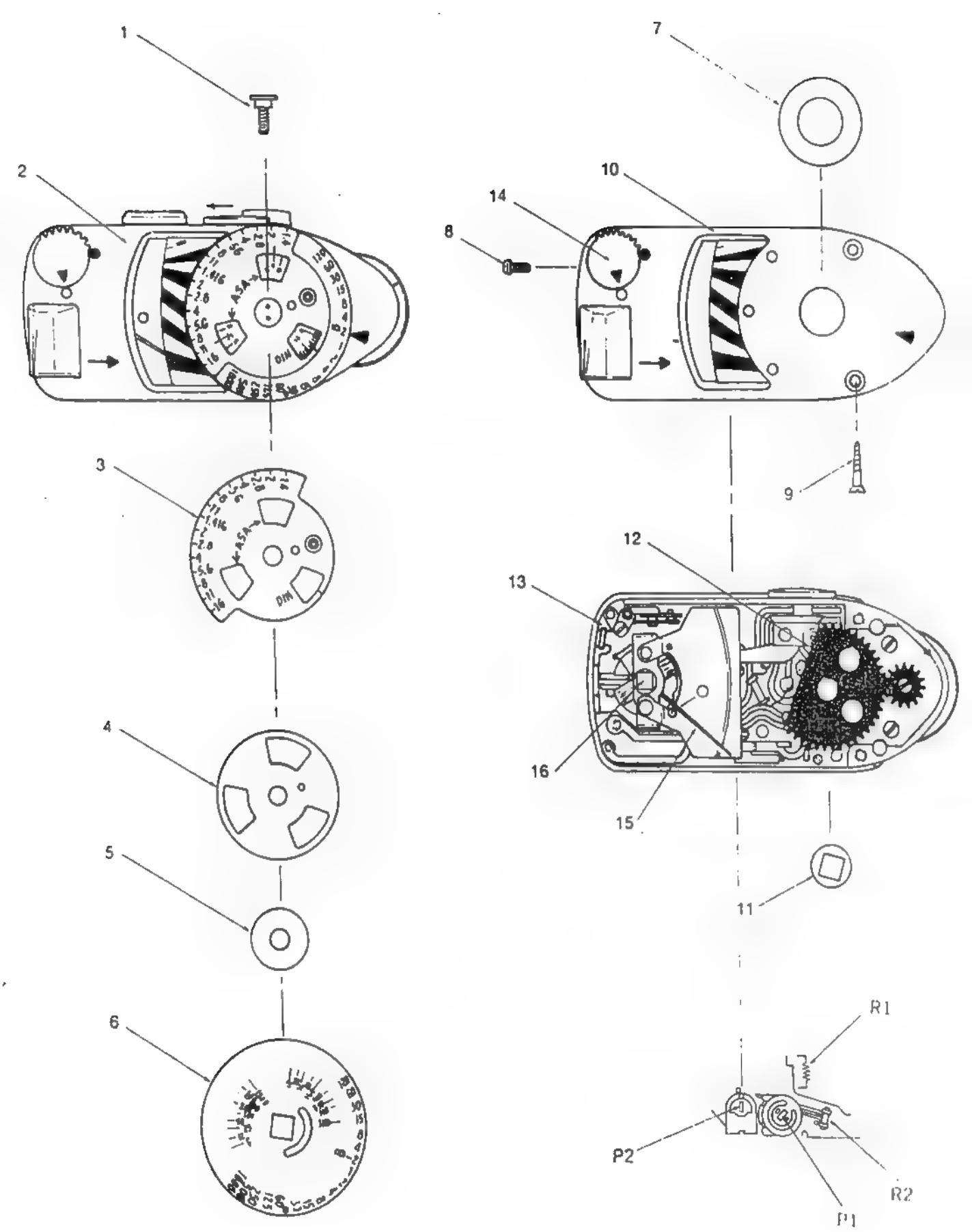

Figure 40. Removal of Exposure Meter Housing.

Figure 40. Legend, Lubrication and Gluing Points.

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Retaining screw	Apply on threads	N–T
2	Exposure meter assembly		
3	Aperture dial		
4	Spacer washer		
5	Spacer washer		
6	Speed dial		
7	Plastic washer	Apply lightly on underside	N–T
8	2 screws		
9	2 screws		
10	Housing		
11	Washer		
12	Spring		
13	Meter circuit insert		
14	Sensitivity switch		
15	Indicator needle		
16	Coil assembly		
P1	Potentiometer		
P2	Potentiometer		
R1	Resistor		
R2	Resistor		

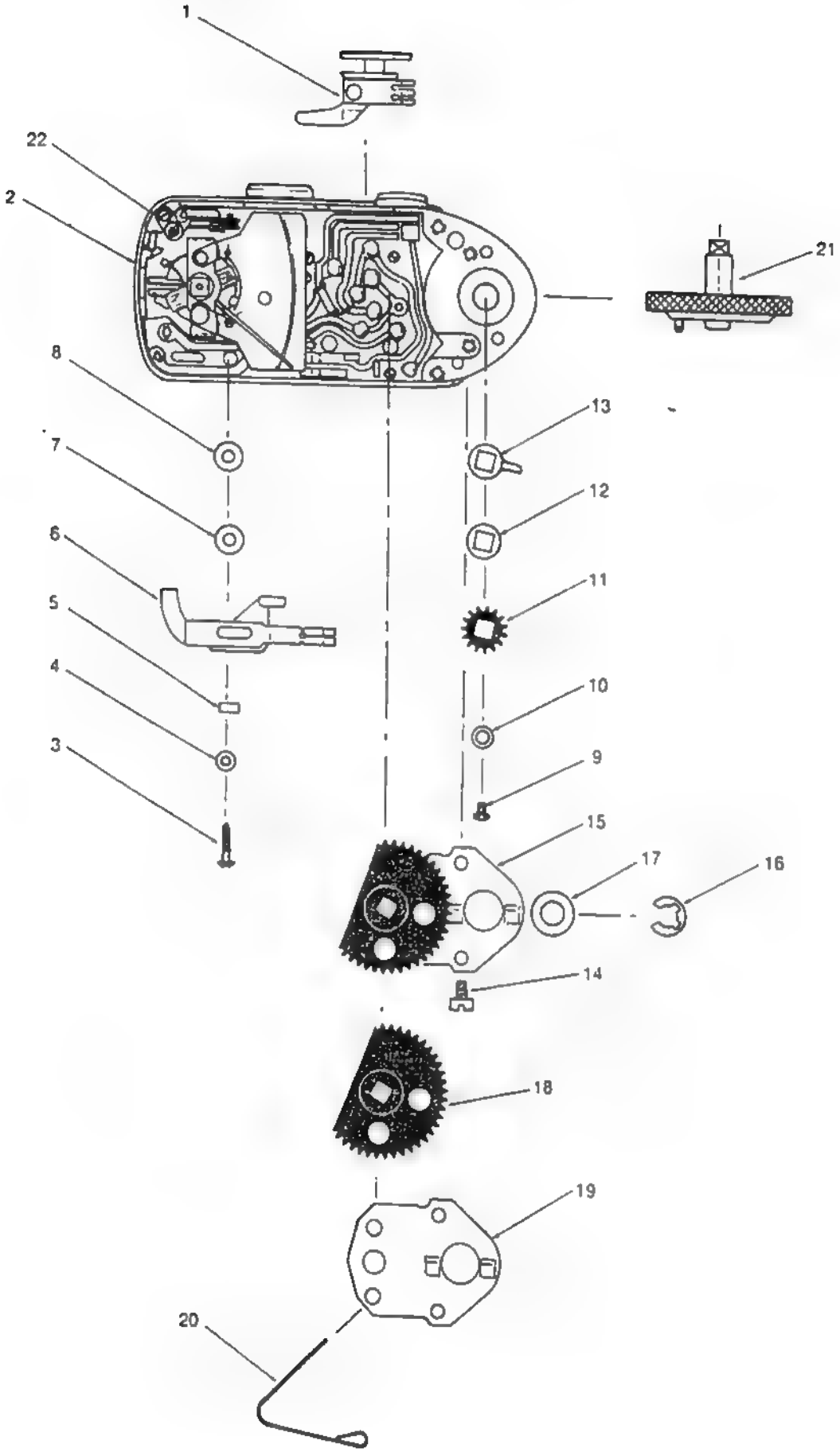

Figure 41. Exposure Meter Switch and Gear Assemblies, Partial Exploded View.

Figure 41. Legend, Lubrication and Gluing Points.

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Battery test switch		
2	Meter circuit insert		
3	Screw		
4	Washer		
5	Spacer		
6	Switch arm		
7	Spacer washer		
8	Insulating washer		
9	Screw	Apply on threads	N–T
10	Washer		
11	Gear		
12	Washer		
13	Nose washer	Apply on nose	B–B
14	2 screws	Apply on threads	N–T
15	Sector-gear assembly		
16	"C" clip		
17	Washer		
18	Sector-gear		
19	Gear mounting plate		
20	Spring		
21	Coupling knob		
22	Sensitivity switch linkage		

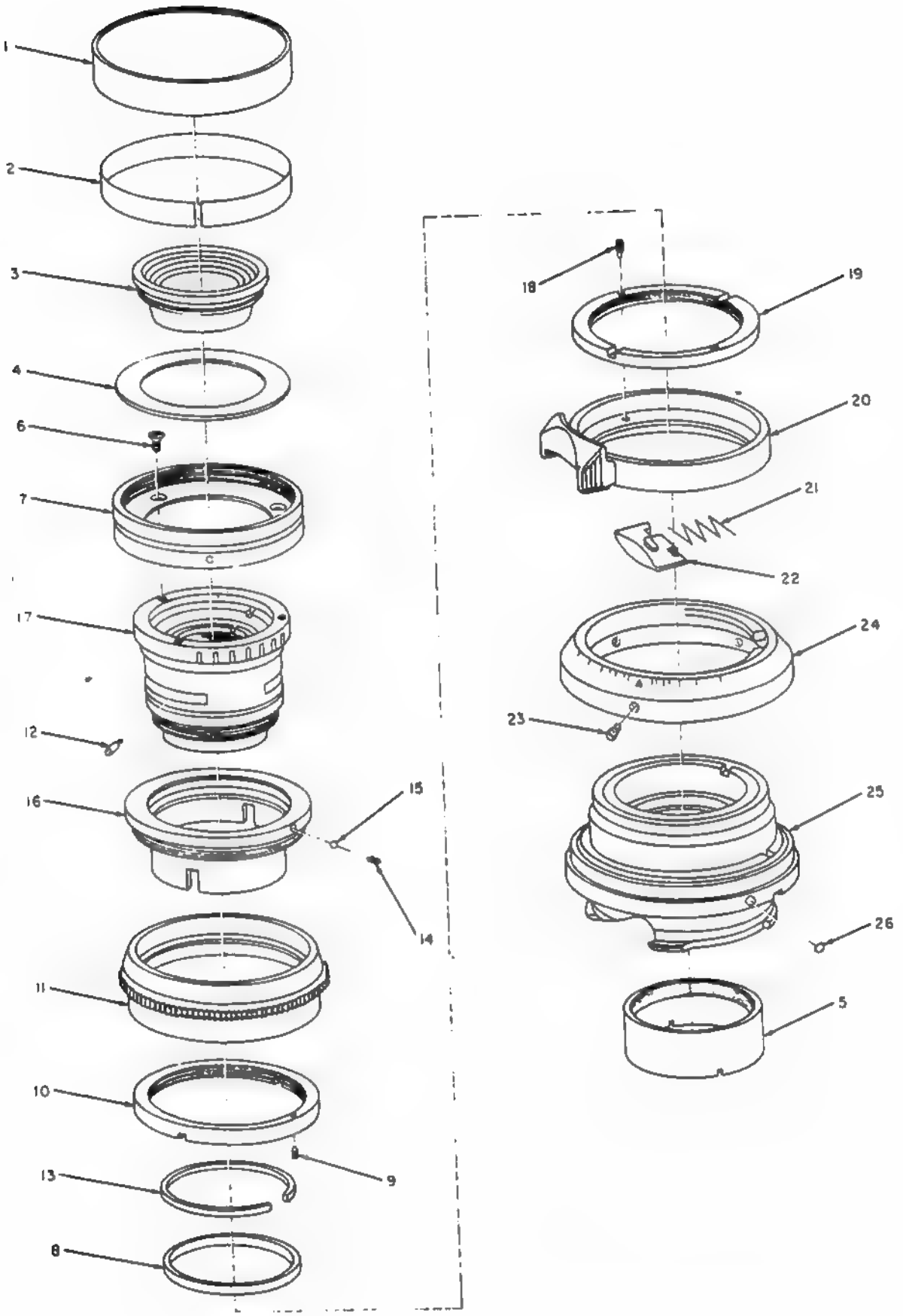

Figure 42. 35mm Lens (Less Optical Components), Exploded View.

b. Electronic Flash. Electronic flash, is in effect, open flash. The first shutter curtain must clear the film aperture, and fire the flash, before the second curtain enters the aperture. The highest shutter speed at which the film aperture is completely uncovered is 1/50–second. This setting is indicated by a lightning stroke symbol on the shutter speed dial.

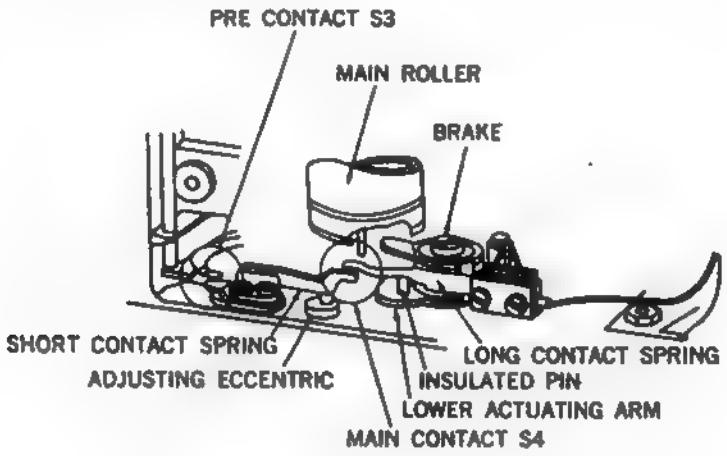

Figure 1–15. Electronic Flash Circuit, Contacts Open.

(1) The synchronizing contacts are located near the bottom of the main shutter roller assembly. The contacts are open when the camera is wound (fig. 1–15), and closed when released. (fig. 1–16).

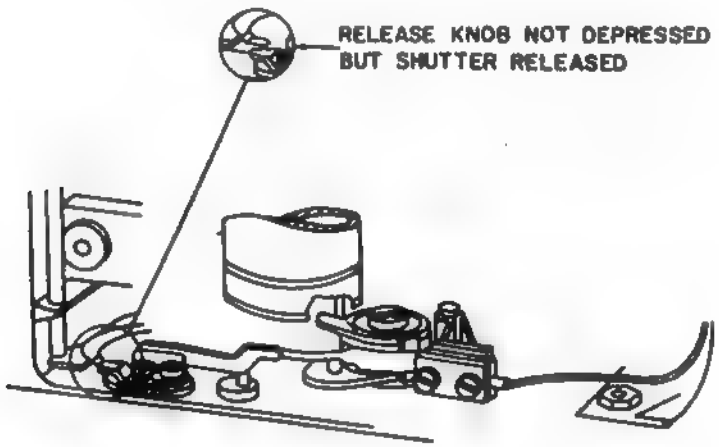

Figure 1–16. Electronic Flash Circuit, Contacts Closed.

(2) The first shutter curtain, after clearing the film aperture, operates the shutter brake. The lower actuating plate of the brake presses an insulated pin (fig. 1–15) against the long contact spring. The long spring moves against a short contact spring and closes the circuit (fig. 1–16). When winding, the shutter brake is released, and the lower actuating arm moves back opening the contacts.

Figure 42. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Lens cap		
2	Lens cap liner	Apply to inner surface	J–B
3	Fluted tube		
4	Serial number ring		
5	Retaining ring		
6	3 screws		
7	Front ring		
8	Adjustment ring		
9	Set screw	Place small amount on threads	N–T
10	Retaining ring		
11	Diaphragm adjusting ring		
12	2 guide screws		
13	Circle clip		
14	Spring		
15	Ball		
16	Inner ring	Apply lightly on entire inside surface	H–F
17	Lens tube		
18	Dowel screw	Place small amount on threads	N–T
19	Retaining ring		
20	Focusing ring		
21	Pressure spring		
22	Sliding bar	Apply small amount on edges	H–T
23	3 screws		
24	Depth-of-field ring		
25	Helical focusing assembly	Apply to helical threads and guides	G–F
26	Mounting indicator	Apply lightly on flat surface	N–T

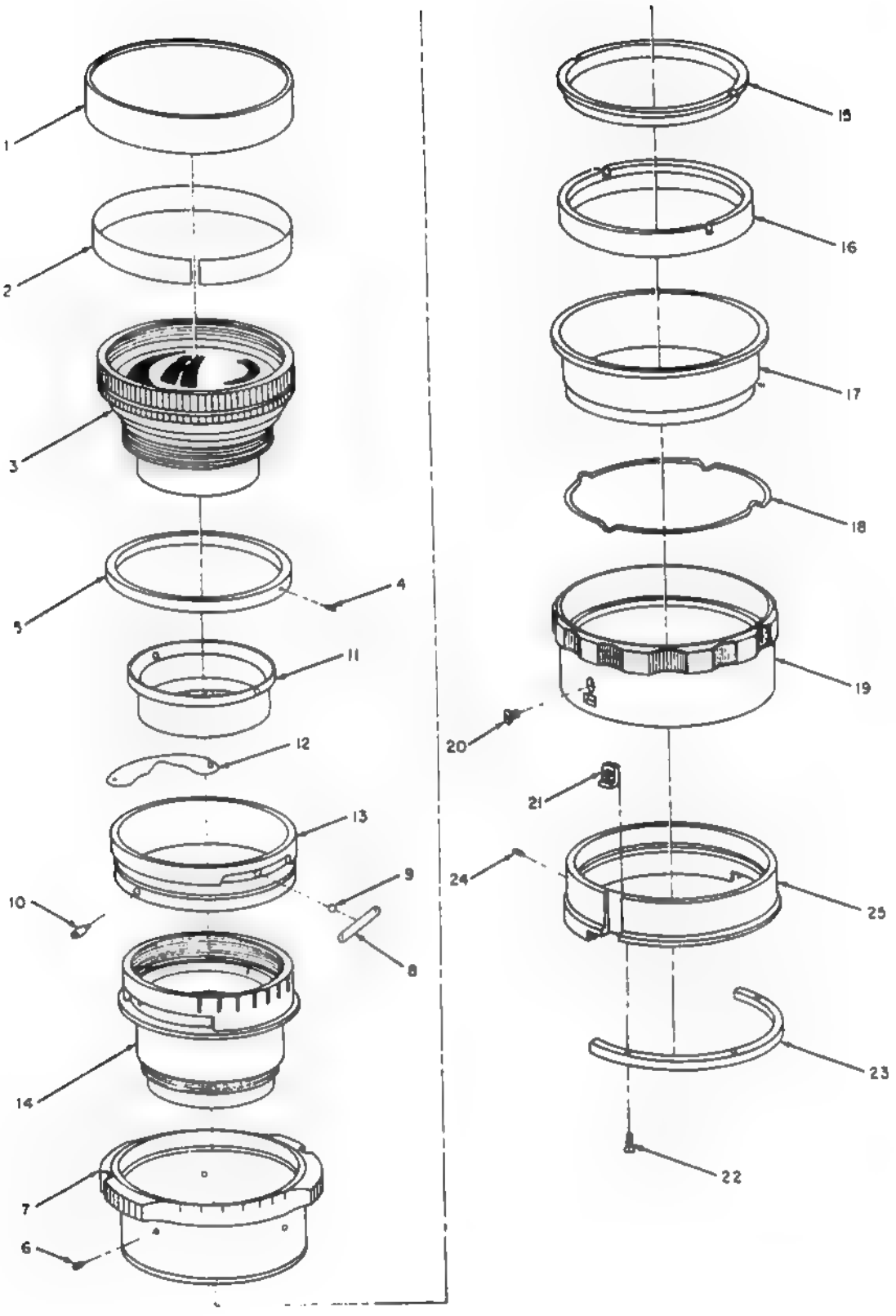

Figure 43. 50mm Lens Head (Less Optical Components) and Focusing Scale Assembly, Exploded View.

Figure 43. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Lens cap		
2	Lens cap liner	Apply to inner surface	J–B
3	Lens mount		
4	Set screw	Place small amount on threads	N–T
5	Index ring		
6	2 set screws	Place small amount on threads	N–T
7	Diaphragm adjusting ring		
8	Flat spring		
9	Ball		
10	2 guide screws		
11	Diaphragm guide ring		
12	10 diaphragm blades		
13	Inner ring	Apply lightly on entire inside surface	H–F
14	Lens tube		
15	Cover ring		
16	Retaining ring		
17	Sleeve	Apply lightly to outside surface, except lip	H–F
18	Spring ring		
19	Focusing ring		
20	Screw	Place small amount on threads	N–T
21	Stop		
22	3 screws		
23	Segment	Apply lightly to outside surface after assembly to (25)	H–F
24	Set screw		
25	Stop ring	Apply lightly to all surfaces	H–F

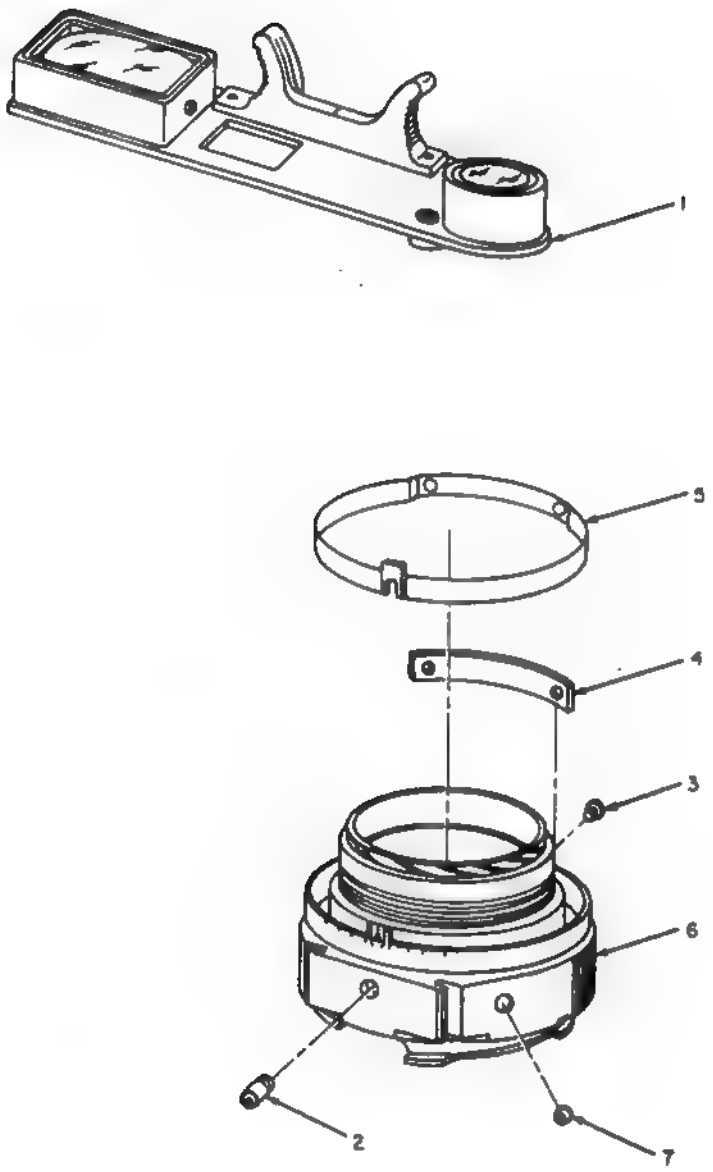

Figure 44. 50mm Helical Focusing Assembly (With Viewing Unit), Partial Exploded View.

Figure 44. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Viewing unit		
2	Nipple	Apply lightly to surface	H–T
3	2 screws		
4	Segment		
5	Stop spring	Apply lightly to all surfaces	H–F
6	Helical focusing assembly	Apply lightly to helical threads and guides	G–F
7	Mounting indicator	Apply lightly to flat surface	N–T

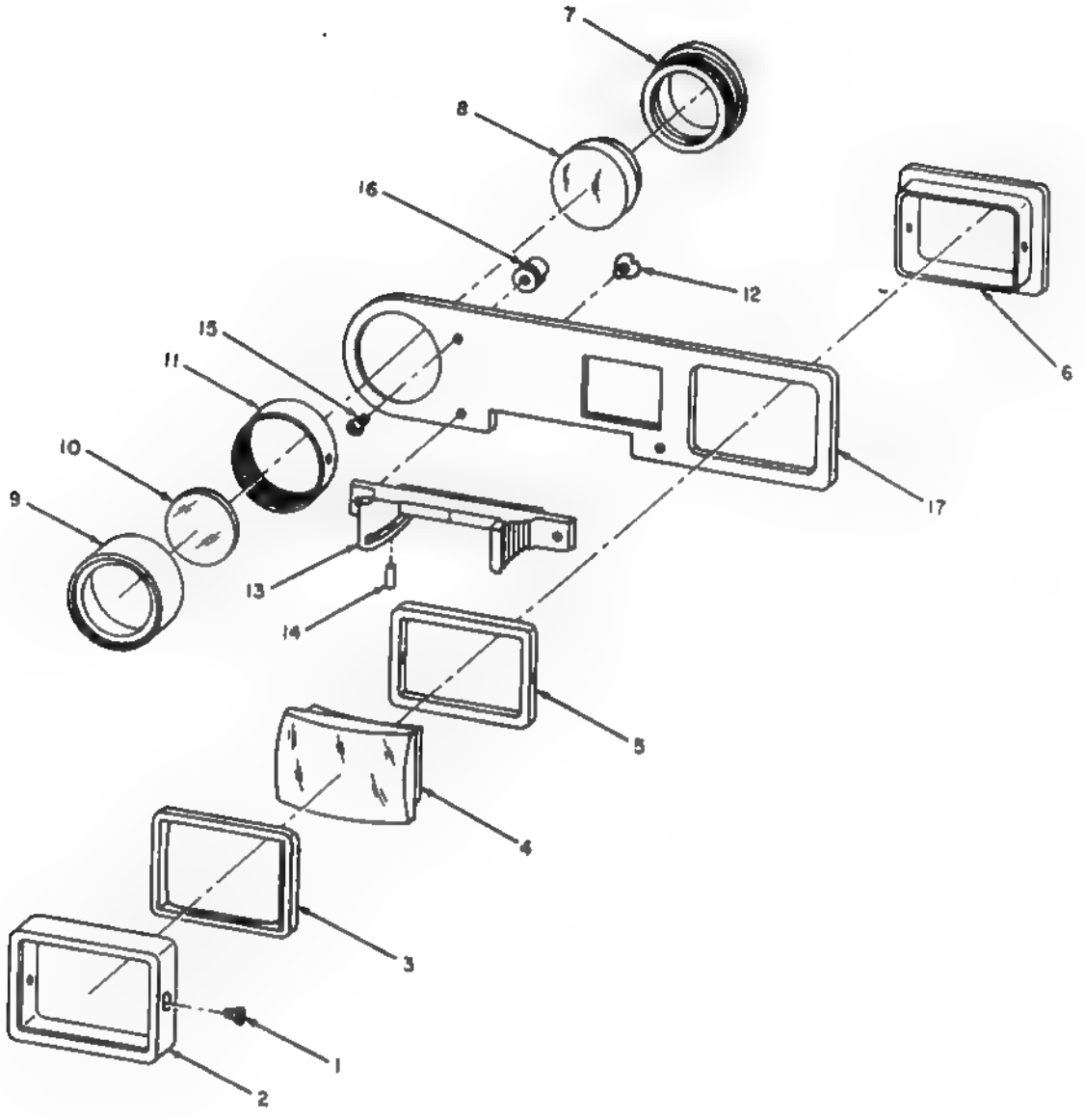

Figure 45. 50mm Viewing Unit, Exploded View.

Figure 45. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	2 screws		
2	Cover shell		
3	Spacer		
4	Optical component		
5	Lens mount		
6	Anchor piece		
7	Lens mount		
8	Optical component		
9	Mount		
10	Optical component		
11	Retaining ring		
12	2 screws	Place small amount on threads	N–T
13	Finger grip		
14	2 stop pins		
15	Screw	Place small amount on threads	N–T
16	Stop	Place small amount on under side	N–T
17	Main plate		

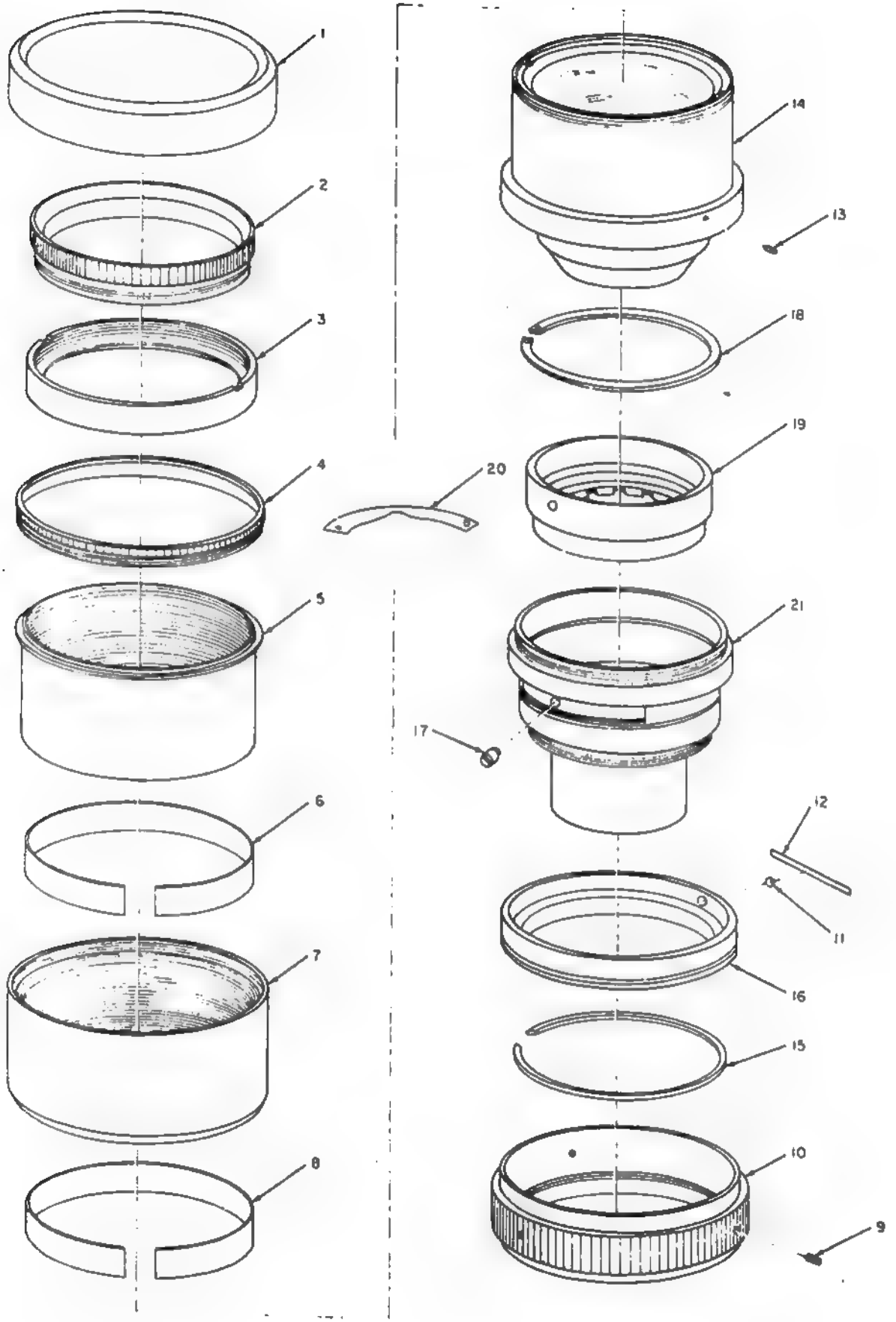

Figure 46. 135mm Lens Head (Less Optical Components), Exploded View.

Figure 46. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Lens cap		
2	Filter retaining ring		
3	Retaining ring		
4	Stop ring		
5	Inner lens hood tube		
6	Lens hood liner	Apply to inner surface	J–B
7	Outer lens hood tube		
8	Lens hood liner	Apply to inner surface	J–B
9	3 set screws	Place small amount on threads	N–T
10	Diaphragm adjusting ring		
11	Ball		
12	Flat spring		
13	Set screw	Place small amount on threads	N–T
14	Lens mount		
15	Circle clip		
16	Inner ring	Place small amount on all surfaces	H–F
17	Guide screw		
18	Circle clip		
19	Diaphragm guide ring		
20	12 diaphragm blades		
21	Lens tube		

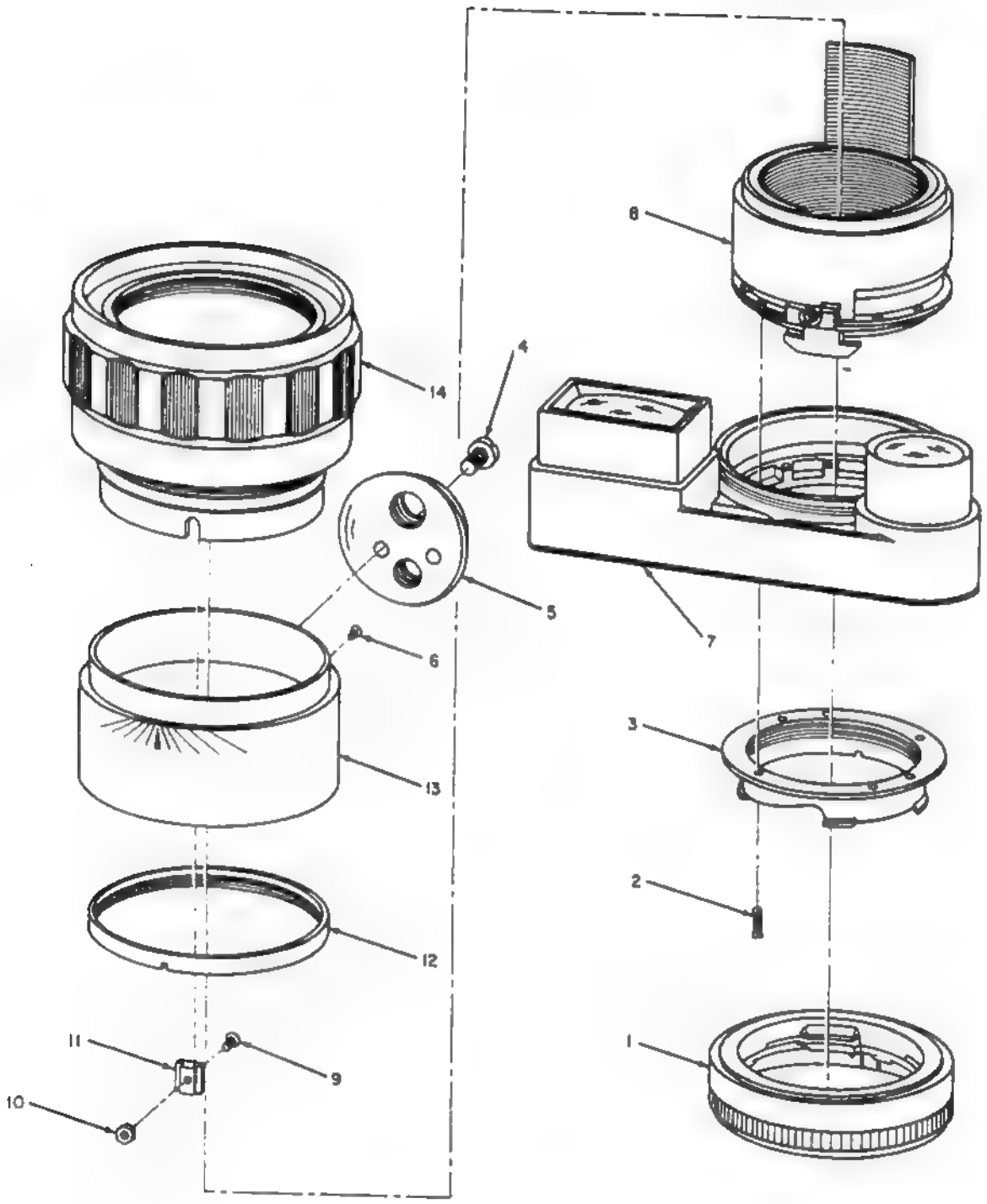

Figure 47. 135mm Focusing Mount, Partial Exploded View.

1–6. Baseplate

(Fig. 22)

In addition to its obvious function of providing access to the camera interior, the baseplate secures the hinged back in closed position, provides a tripod bushing, guides the take up spool, alignes the film with the film advancing sprocket, and opens the metal film magazine.

a. Film Positioning Disc. The film positioning disc has cut-out sectors which engage the film loading prongs. The disc serves as a bearing for the prongs and aligns the film with the film transport mechanism.

b. Lock Assembly. The baseplate lock assembly secures the baseplate to the camera and opens the metal film magazine. An angled stop limits rotation of the lock assembly and releases the retaining spring of the metal magazine.

(1) The locking plate is slightly wedged shape. When the lock is turned from the open to closed position, the plate engages a locking bar on the camera's inner housing. The wedge shape of the plate pulls the baseplate tight to the camera body. Two projections on the locking plate strike the angled stop and prevent rotation of the lock beyond the open or closed position.

(2) When the baseplate is mounted on the camera, the curved edge of the angled stop pushes back the magazine retaining spring and unlocks the magazine. A groove in the locking plate engages the magazine inner shell knob. When the baseplate lock is turned to the closed position, the magazine inner shell is turned to its open position. Turning the lock to its open position closes the magazine. Removing the baseplate reengages the magazine retaining spring, and locks the magazine in the closed position.

1–7. Hinged Back

(Fig. 23)

The hinged back, in addition to opening for camera loading, also carries a pressure plate and studs for positioning the film.

a. Pressure Plate. When the hinged back is closed, a spring pushes the pressure plate against two outer film guides on the inner housing. The film rests between the outer guides and on the inner film tracks in the film plane. This provides a "breathing" space and assures smooth transport of the film.

b. Film Positioning Studs. When the hinged back is closed, the positioning studs rest against the outer edges of the film. This holds the film perforations in engagement with the sprocket wheel teeth.

Figure 47. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Rear cap		
2	6 screws		
3	Bayonet ring		
4	2 screws		
5	Tripod bushing plate		
6	Screw		
7	Viewing unit		
8	Differential cam assembly	Apply to inside surface of helix and edges of guides	H–F
9	Screw	Place small amount on threads	N–T
10	Nut		
11	Stop	Apply small amount to edges	H–T
12	Retaining ring		
13	Depth-of-field ring	Apply small amount to inside surface	H–F
14	Helical focusing assembly	Apply small amount to helical threads	G–F

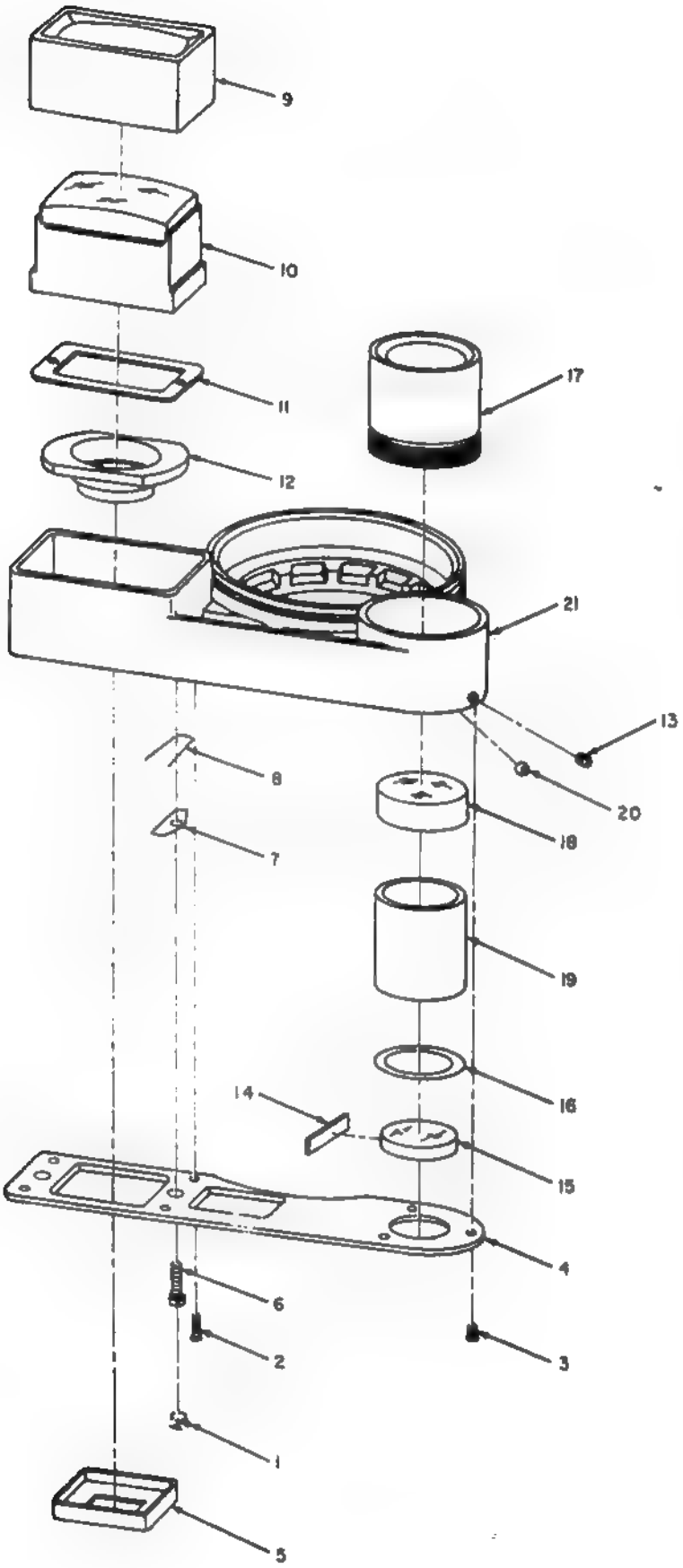

Figure 48. 135mm Viewing Unit, Exploded View.

Figure 48. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	2 cover screws	Place small amount on threads	N–T
2	4 screws		
3	3 screws		
4	Cover plate		
5	Mask		
6	2 screws	Place small amount on threads	N–T
7	Retaining plate		
8	Pressure spring		
9	Cover shell		
10	Optical component and mount		
11	Spacer		
12	Optical component and mount		
13	2 adjusting screws		
14	Flat spring		
15	Optical element		
16	Shim		
17	Lens mount		
18	Optical component		
19	Spacer tube		
20	Mounting indicator	Apply lightly to flat surface	N–T
21	Main housing		

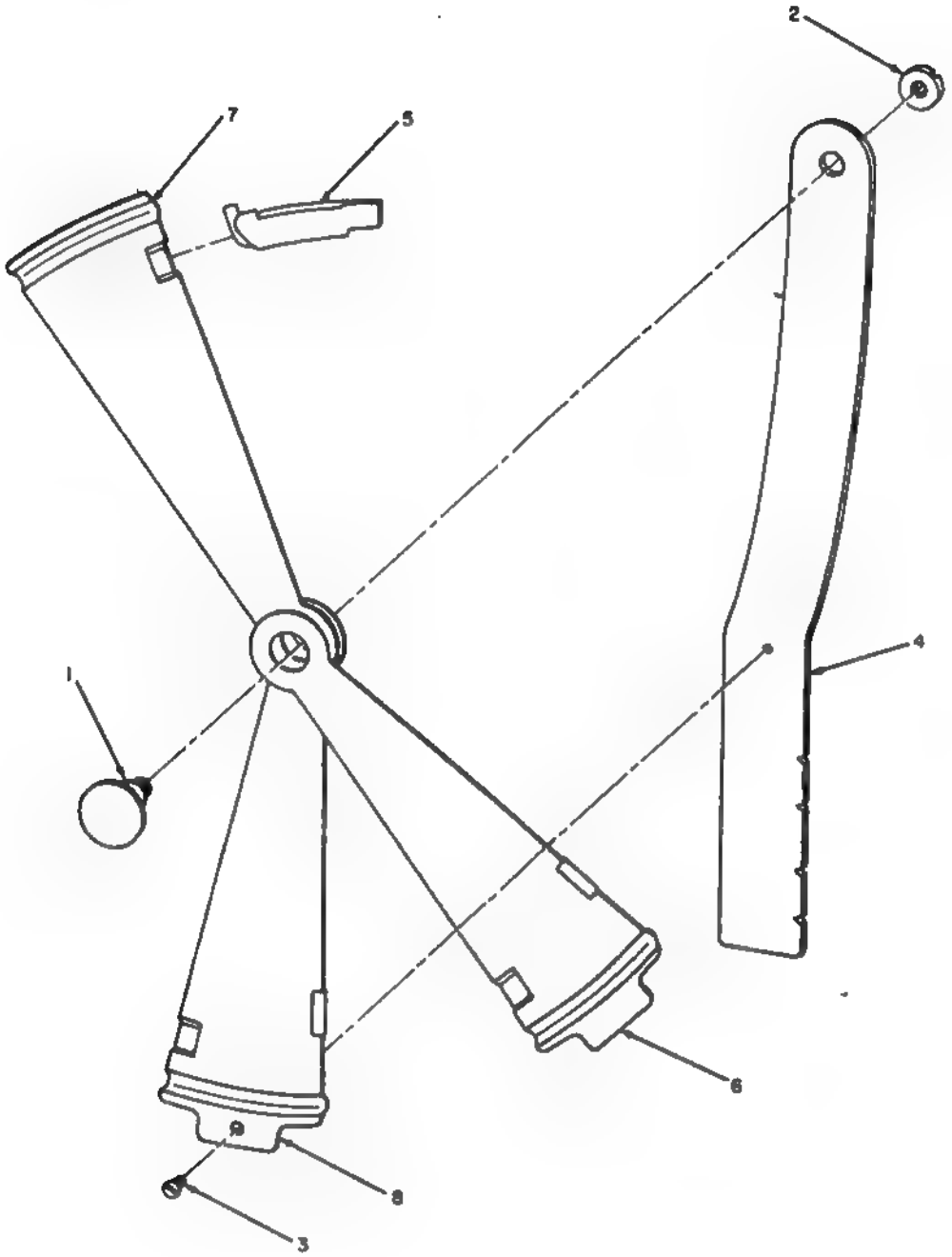

Figure 49. Flash Unit Reflector, Partial Exploded View.

Figure 49. Flash Unit Reflector

1. Shoulder screw
2. Ring nut
3. Screw
4. Reflector handle
5. Segment cleat
6. Upper reflector segment
7. Reflector segment
8. Lower reflector segment

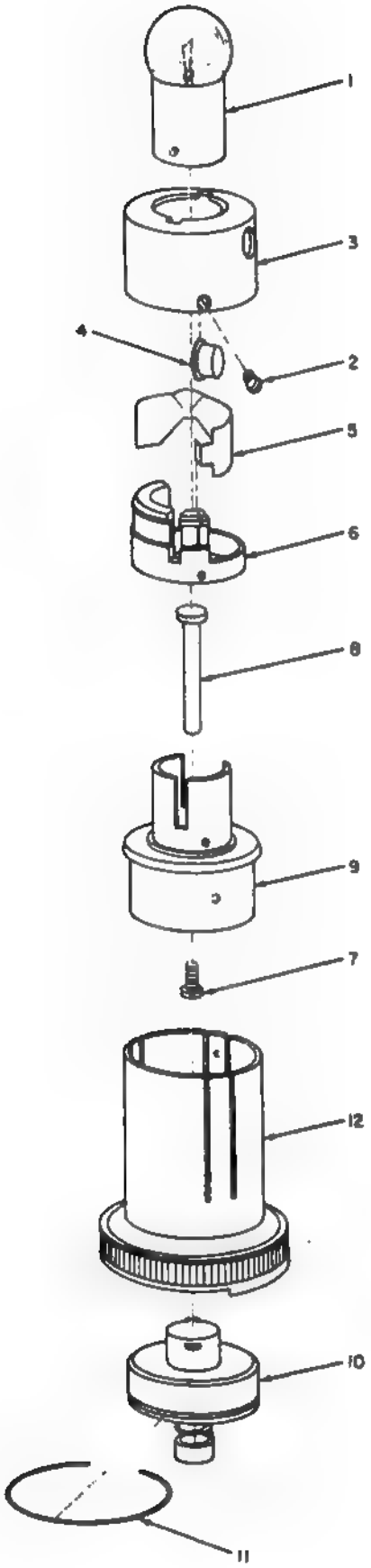

Figure 50. Flash Unit Lamp Socket and Bayonet Adapter, Exploded View.

Figure 50. Flash Unit Lamp Socket and Bayonet Adapter.

1. Test lamp
2. 3 screws
3. Bayonet socket shell
4. Ejector button
5. Release spring
6. Intermediate sleeve
7. Screw
8. Contact pin
9. Bayonet socket inner sleeve
10. Contact spring assembly
11. Retaining ring
12. Medium screw-base lamp socket

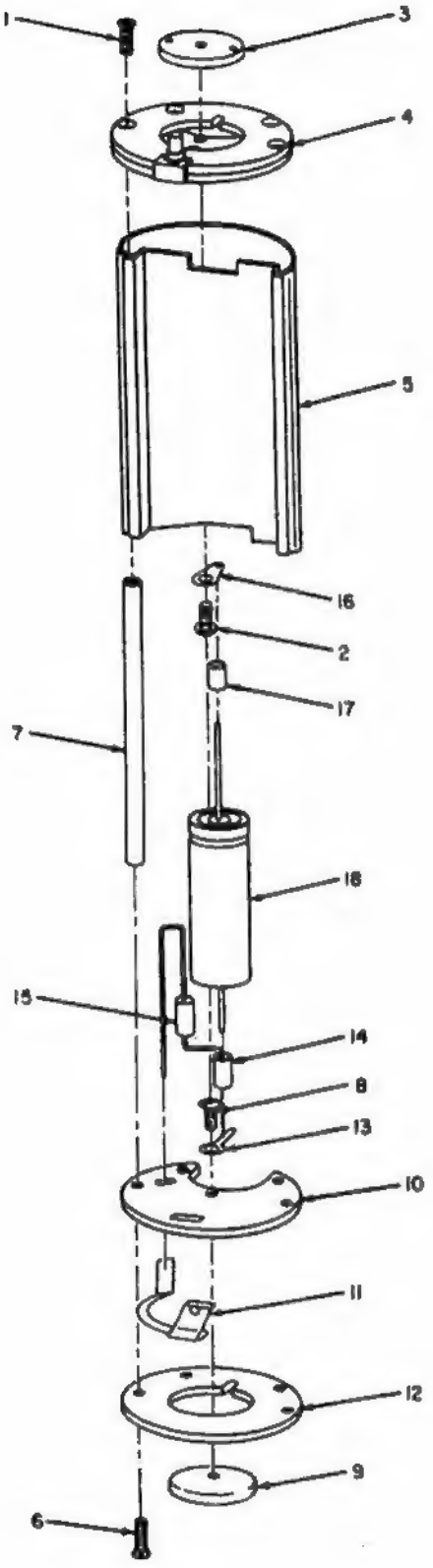

Figure 51. Flash Unit Battery-Capacitor Insert, Exploded View.

Figure 51. Flash Unit Battery-Capacitor Insert.

1. 4 screws
2. Screw
3. Round nut
4. Upper plate assembly
5. B–C housing
6. 4 screws
7. 4 assembly rods
8. Screw
9. Round nut
10. Lower inside plate
11. Contact spring
12. Lower outside plate
13. Soldering lug
14. Insulating sleeve
15. Resistor
16. Soldering lug
17. Insulating sleeve
18. Capacitor

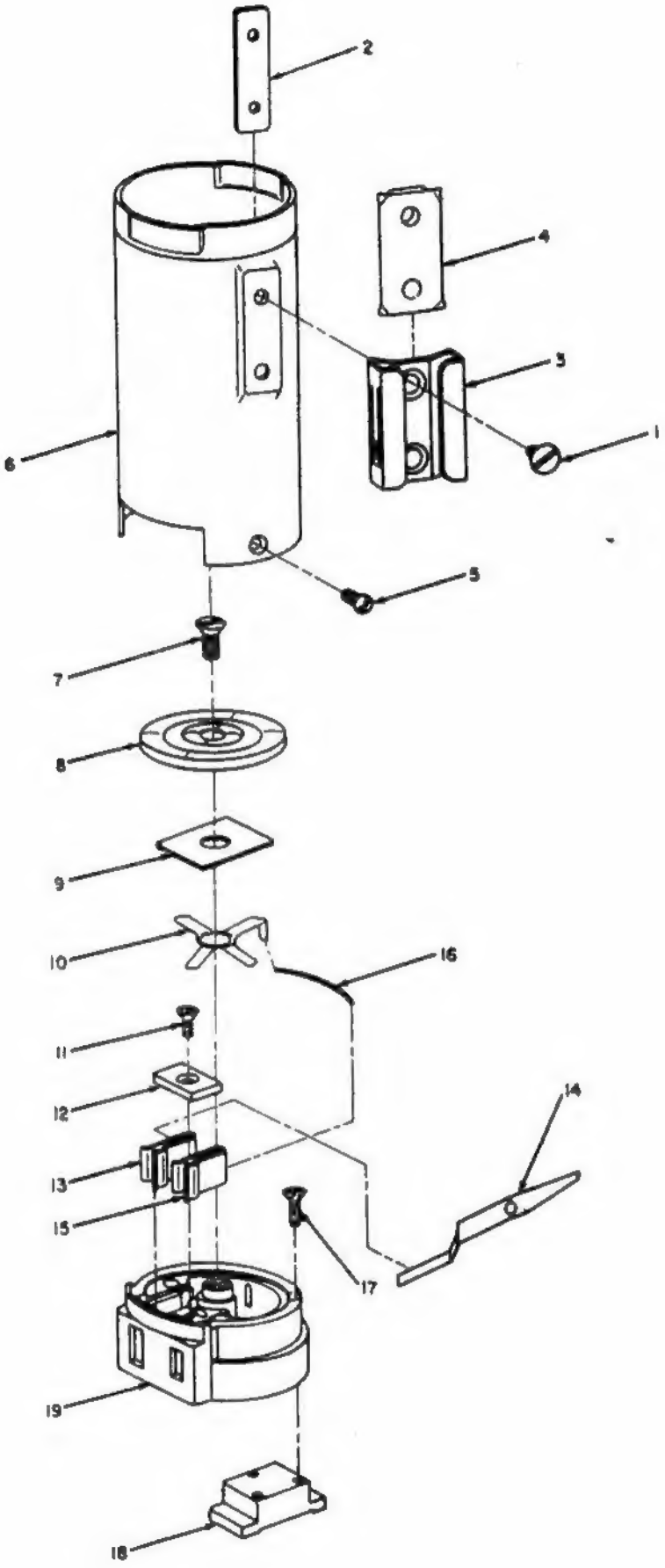

Figure 52. Flash Unit Housing, Exploded View.

Section II. EXPOSURE METER

1–8. General

General functioning of the exposure meter furnished with the KS–15(4) Still Picture Camera Set is described in TM 11–6720–244–12, paragraph 6-3. Following is supplemental information not contained in TM 11–6720–244–12.

a. Light Measuring Circuit (fig. *a*).

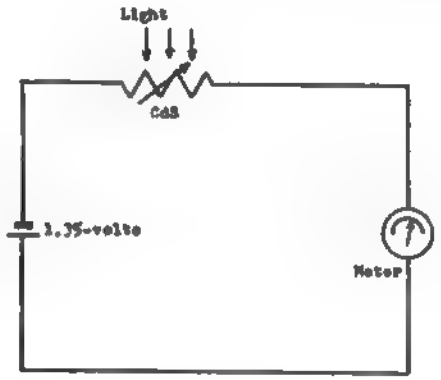

Figure a. Light Measuring Schematic.

A photo-resistor (CdS cell), battery and ammeter are in series. When the cell is dark it has an infinite resistance and no current flows. The resistance of the cell decreases in proportion to the intensity of the light incident to it. As light intensity increases, current flow increases and is measured by the meter.

b. Battery Test Circuit (fig. *b*).

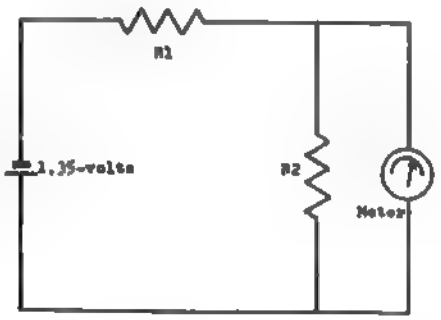

Figure b. Battery Test Circuit.

Actuating the battery test switch disconnects the CdS cell and substitutes resistor (R1). Resistor (R2) is placed in series with (R1) and the battery. The meter is connected across (R2) and measures the voltage drop.

Figure 52. Flash Unit Housing

1. 2 screws
2. Retaining plate
3. Reflector mounting bracket
4. Pressure spring
5. 3 screws
6. Battery housing
7. Screw
8. Contact plate
9. Rectifier
10. Contact spring
11. Screw
12. Insulating strip
13. Wide contact clip
14. Contact strip
15. Narrow contact clip
16. Contact wire
17. 3 screws
18. Mounting foot
19. Bottom block

Section III. LENSES

1–9. General

General functioning of lenses furnished with the KS–15(4) Still Picture Camera Set is described in TM 11–6720–244–12, paragraph 6–2. All lenses in the set have parallel focusing mounts and couple with the camera's built-in rangefinder. Following is supplemental information not contained in TM 11–6720–244–12.

1–10. 35mm Lens Focusing Mount and Rangefinder Coupling

(Fig. 42)

a. Parallel Focusing. Focusing ring (20) is secured to the outer ring of the forward helix, which is part of the helical focusing assembly, by retaining ring (19). The inner portion of the helix has a milled slot which mates with a fixed guide in the differential focusing assembly. Rotation of the focusing ring moves the inner helix longitudinally. The fixed guide prevents it from rotating.

b. Rangefinder Coupling. The inner helix of the differential focusing assembly has a milled slot. This mates with a guide secured to the outer ring of the forward helix. Rotation of the focusing ring turns the inner helix, which actuates the camera rangefinder. It has a steeper pitch than the forward helix, and the same longitudinal displacement as a 50mm lens.

1–11. 50mm Lens Focusing Mount and Rangefinder Coupling

(Fig. 43, 44)

a. Parallel Focusing. Retaining ring (16), figure 43, secures the focusing ring assembly to the outer ring of the forward helix, which is part of helical focusing assembly (6), figure 44. The inner portion of the helix has a milled slot which mates with a fixed guide. Rotation of the focusing ring moves the inner helix longitudinally. The fixed guide prevents it from rotating.

b. Rangefinder Coupling. The 50mm lens has a two-step cam. The lower cam engages the rangefinder roller arm when focusing at distances between 3-feet, 4-inches and infinity. Its longitudinal movement is in direct relation to that of the lens elements. The higher cam actuates the rangefinder arm when focusing for closer distances. The height of the cam compensates for the increased forward movement of the lens in the close-up range. The longitudinal movement of the close-range cam is not in direct relation to that of the lens. The viewing unit, used in the close range, alters the rangefinder optical system.

1–12. 135mm Lens Focusing Mount and Rangefinder Coupling

(Fig. 47)

a. Parallel Focusing. The inner helix of helical focusing assembly (14) has a milled slot which mates with a fixed guide on differential cam assembly (8). Rotation of the focusing ring moves the inner helix longitudinally. The fixed guide prevents it from rotating.

b. Rangefinder Coupling. The differential cam has a milled slot. This mates with stop (11) which is secured to the outer helix of helical focusing assembly (14). Rotation of the focusing ring turns the differential cam. The inclined edge of the differential cam rides against a spring-loaded arm, which actuates the camera rangefinder. The longitudinal displacement of the arm differs from that of a 50mm lens. This is necessitated by the viewing unit which alters the optical system of the rangefinder.

c. Viewing Unit. The functioning of the 135mm viewing unit is described in TM 11–6720–244–12, paragraph 6–2*d*(3) (*c*).

Section IV. FLASH UNIT

1–13. Flash Unit

(Fig. 1–17).

The flash unit is powered by a B-C insert and connected to the camera's flash lamp socket by a connecting cord. It fits into the accessory clip on the camera, or may be hand-held for off-camera use. A tripod socket in the base of the flash unit permits tripod mounting. The reflector may be removed from the unit and folded for carrying in the universal case.

a. Mechanical Functioning. The reflector may be adjusted in height for centering with the flash bulb. Medium screw-base flash bulbs or, with an adapter, bayonet-base bulbs may be used. The bayonet-base adapter is equipped with a bulb ejector.

(1) Height adjustment of the reflector is secured by a spring in the reflector mounting bracket. The spring engages notches in the reflector handle.

(2) Medium screw-base bulbs are held in the lamp socket by spring clips which form part of the socket. The bayonet-base adapter fits into the medium-base socket in the same manner as a blash bulb. Bulbs are ejected by the adapter's contact spring when the ejector button is depressed.

b. Electrical Functioning. The B–C (battery-capacitor) insert has a compartment for holding the 22–1/2 volt battery. The assembly fits into the flash unit housing. A selenium rectifier, in the base of the housing, prevents reverse current flow (premature firing) when using multiple units in parallel.

(1) *B–C insert.* The insert contains a 10,000–ohm resistor and 100 microfarad capacitor. Electrical connection is made by contact plates on each end of the insert.

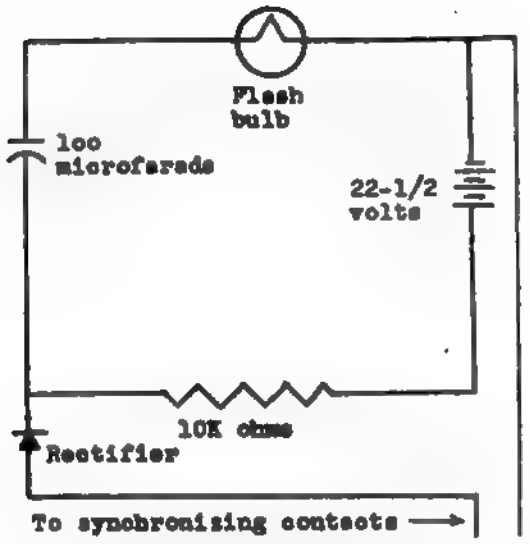

Figure 1–17. Flash Unit Circuit, Schematic.

(2) *Circuit* (fig. 1–17). The capacitor charging circuit is closed by inserting a bulb in the flash unit socket. Current flows from the battery through the filament, the capacitor and resistor. The resistor limits the current to a value lower than that necessary to fire the bulb. When the synchronizing contacts of the camera are closed, the capacitor discharges. The flow of current (which bypasses the resistor) is through the filament of the bulb, connecting cord, camera synchronizing contacts, and the rectifier. Ignition of the lamp destroys its filament and opens the circuit.

CHAPTER 2

TROUBLESHOOTING

Section I. CAMERA BODY

2–1. General

The photographic effects of equipment malfunctions are detailed in paragraph 4–8 of the KS–15(4) Operator's Manual TM 11–6720–244–12. Mechanical and optical malfunctions of the camera body are listed in the following troubleshooting chart.

NOTE: Gages and test equipment should be used at all times; not only to pinpoint the malfunction, but to make certain the equipment is properly adjusted. The camera body should be completely checked, and all malfunctions located, before repair is started.

a. Most malfunctions will become obvious to the experienced repairman by a careful examination of the camera. Other malfunctions may require partial disassembly of the equipment.

b. After the camera has been repaired and adjusted, it should be tested photographically. The final test of any photographic system is its ability to accurately and clearly record information. The processed film should be examined for frame position, evenness of exposure and exposure density, image sharpness and scratches.

c. Troubleshooting Chart.

MALFUNCTION	PROBABLE CAUSE	REMEDY
Shutter release knob cannot be depressed.	Release disc (14) fig. 35 loose	Tighten disc
	Release sleeve (32) fig. 21, has shifted	Reposition sleeve slot in pin
Shutter does not release when release knob is depressed.	Foreign matter or rust in shutter mechanism	Remove foreign matter
Shutter curtains do not open when release knob is depressed.	Flat spring (20) fig. 35 incorrectly adjusted	Adjust flat spring
	Arresting lever "B" (34) fig. 31, incorrectly adjusted	Adjust arresting lever "B"
	Foreign matter between bottom cover plate (5) fig. 25, and flat spring (20) fig. 35	Remove foreign matter
Winding lever loose, no friction.	Loose screw ring (6) fig. 21	Tighten ring
	Defective spring washer (7) fig. 21	Replace washer

MALFUNCTION	PROBABLE CAUSE	REMEDY
Winding lever cannot be advanced.	Foreign matter in winding, shutter or release mechanism	Remove foreign matter
	Loose sprocket wheel shaft bearing (47) fig. 35	Tighten bearing
	Two-part intermediate gear (25) fig. 35, incorrectly positioned	Re-align gear
Winding lever will not fully wind shutter.	Defective ratchet plate (7) fig. 34	Replace ratchet plate
	Broken or misaligned gear in winding or shutter mechanism	Replace or re-align gear causing the malfunction
Frame counter rotates to freely.	Defective spring washer (30) fig. 21.	Replace washer
Rewind knob pulls up with difficulty, or will not stay up.	Defective slotted friction sleeve (23) fig. 21	Replace sleeve or clean and lubricate.
Rewind knob turns with difficulty.	Dry rewind assembly bearings	Clean and relubricate
Rewind knob will not rotate.	Damaged rewind assembly gears	Replace damaged gears
Rewind knob rotates without rewinding film.	Sheared rewind knob shaft key.	Replace rewind knob
	Defective forked carrier (24) fig. 21	Replace carrier
Frame selector lever will not position bright-line frames.	Defective range-viewfinder mask adjusting mechanism	Repair or replace mechanism
	Spring (33) fig. 39, disconnected from frame selector bars, or defective	Reconnect spring, or replace
Reverse lever remains in "R" position when winding shutter.	Defective coupling disc, fig. 1-2	Replace coupling disc
	Defective camshaft (17) fig. 36	Replace camshaft.
Delayed action lever will not fully wind clockwork.	Loose screw (1) fig. 39	Reset winding mechanism and tighten screw
	Broken main spring (1) fig. 29 in clockwork	Replace spring
Delayed action release button will not activate clockwork.	Foreign matter in delayed action release clockwork	Remove foreign matter
Lens lock release remains in depressed position.	Foreign matter under "C" clip (18) fig. 39	Remove foreign matter

MALFUNCTION	PROBABLE CAUSE	REMEDY
Locked lens can be rotated slightly positioning incorrect brightline frames.	Worn slot in lens mounting flange	Replace lens mounting flange
Lens seats roughly or loosely in lens mounting flange.	Worn or damaged flange ring (23) fig. 39	Replace flange ring
	Worn or damaged spring ring (25) fig. 39	Replace spring ring
Light leaks on film.	Loose or missing eyelets (43) fig. 39	Replace eyelet
	Hole in shutter curtains	Replace defective curtain
	Deformed shutter curtains	Replace curtains
	Damaged or missing light shields.	Replace light shields.
	Defective or misadjusted shutter brake	Replace or adjust shutter brake.
	Defective guide spring (14) fig. 30	Replace guide spring
Shutter does not completely traverse film aperture when release knob is depressed.	Shutter curtain ribbons Fig. 1-2 loose	Reglue ribbons
	Light shield felt strips loose.	Reglue felt strips
	Loose stop disc retaining nut (29) fig. 35	Adjust and tighten nut
	Slow speed escapement hanging at shutter speeds below 1/50-second	Clean and repair slow speed escapement
Unequal spacing between frames.	Loose stop disc retaining nut (29) fig. 35	Adjust and tighten nut
	Loose sprocket wheel screw (34) fig. 35	Tighten screw.
	Improper friction of rewind knob assembly fig. 31	Clean, lubricate and adjust rewind knob assembly
	Improper adjustment of compensating friction clutch fig. 1-2.	Readjust friction clutch
Baseplate lock has no positive stop.	Locking plate stops (5) fig. 22, bent	Straighten stops
	Angled stop fig. 22, bent or broken	Straighten stop or replace baseplate.
Baseplate lock has insufficient friction.	Defective upper or lower spring washer (7) & (10) fig. 22	Replace spring washer

MALFUNCTION	PROBABLE CAUSE	REMEDY
Shutter speeds below 1/50-second too slow.	Foreign matter in slow speed escapement	Remove foreign matter
	Slow speed escapement dry	Clean and lubricate
Shutter speeds below 1/50-second too fast.	Slow speed escapement anchor does not fully engage	Readjust anchor
	Hair spring on gear (8) fig. 32 defective	Replace slow speed mechanism
	Spring tension of second shutter curtain too high	Reduce spring tension
Shutter speeds higher than 1/50-second too slow.	Foreign matter in shutter mechanism	Clean and relubricate
	Dry shutter mechanism bearings.	Clean and lubricate bearings.
	First Shutter curtain spring tension too high	Adjust tension
	Second shutter curtain spring tension too low	Adjust tension
Shutter speeds higher than 1/50-second too fast.	First shutter curtain spring tension too low	Adjust tension
	Second shutter curtain spring tension too high	Adjust tension
Uneven exposures	Foreign matter in shutter mechanism	Clean and relubricate
	Dry shutter mechanism bearings.	Clean and relubricate bearings
	Shutter spring tensions not properly adjusted	Adjust spring tensions of shutter curtains.
Flash bulb does not fire when shutter release is depressed.	Note: Shutter must be correctly adjusted before trouble-shooting synchronization.	
	Damaged flash lamp socket	Repair or replace socket
	Flash lamp socket lead defective	Resolder or replace lead
	Foreign matter between contacts or precontact switch (S1) fig. 4-13	Clean contacts
	Pitted or burned contacts of switch (S2) fig. 4-13.	Replace synchro adjusting lever and clean contact switch of synchro adjusting arm.

MALFUNCTION	PROBABLE CAUSE	REMEDY
Flash unit fires when connecting cord is inserted in flash lamp socket.	Shorted flash lamp socket	Repair or replace socket
	Flash lamp socket lead grounded	Repair or replace lead
	Precontact switch upper spring (S1) fig. 4-13, grounded	Remove ground. Replace insulation plates if required
	Insulating cap (35) fig. 31 of arresting lever missing	Replace insulating cap
Flash bulb fires when winding shutter.	Shorted precontact switch	Remove short
Flash unit fires eratically.	Intermittent open in flash lamp socket	Repair or replace socket
	Intermittent open in flash lamp socket lead	Resolder or replace lead
	Intermittent contact of precontact switch (S1) fig. 4-13, due to foreign matter	Remove foreign matter
	Dirty, pitted or burned contacts of switch (S2) fig. 4-13	Clean switch contacts. Replace synchro adjusting lever if necessary.
	Broken or disconnected ground wire (9) fig. 31	Resolder or replace wire
Flash bulb fires too early or too late.	Incorrectly adjusted contact arm fig. 4-13	Readjust synchro adjusting arm.
Electronic flash does not fire when shutter release is depressed.	Damaged electronic flash socket	Repair or replace socket
	Foreign matter between contacts of precontact switch (3) fig. 4-15	Clean contacts
	Pitted or burned contacts of precontact switch (3) fig. 4-15.	Replace flat spring (20) fig. 35 with contact spring and contact spring (9) fig. 30
	Foreign matter between contacts of main contact switch (4) fig. 4-15	Remove foreign matter
	Pitted or burned contacts of main contact switch (4) fig. 4-15	Replace short contact spring (9) and long contact spring (3) fig. 30
	Electronic flash socket lead defective	Resolder or replace lead
Electronic flash fires when connecting cord is inserted in electronic flash socket and shutter is wound or released.	Shorted electronic flash socket.	Repair or replace socket
	Electronic flash socket lead (16) fig. 30 grounded	Repair or replace
	Grounded long contact spring (3) fig. 30.	Remove ground. Replace insulation plates (2) & (4) fig. 30 if required

MALFUNCTION	PROBABLE CAUSE	REMEDY
Electronic flash fires when connecting cord is inserted in electronic flash socket and shutter is released.	Grounded short contact spring (9) fig. 30	Remove ground. Replace insulation plates (7), (8) and (10) fig. 30 if required
	Helical spring (28) fig. 35, disengaged from insulated stop and touching short contact spring (9) fig. 30	Relocate spring against stop
	Foreign matter between contacts of precontact switch (3) fig. 4-15	Remove foreign matter
Electronic flash fires eratically.	Intermittent open in electronic flash socket	Repair or replace socket
	Intermittent open in electronic flash socket lead (16) fig. 30	Resolder or replace lead
	Intermittent contact of precontact switch (3) fig. 4-15 due to foreign matter	Remove foreign matter
	Dirty, pitted or burned contacts or precontact switch (3) or main contact switch (4) fig. 4-15	Clean switch contacts. Replace switch components if required
	Broken or disconnected ground wire (11) fig. 30	Resolder or replace wire
	Loose guide spring retaining nut (12) fig. 30	Tighten nut
	Insufficient tension of short or long contact springs (9) & (3) fig. 30 in main contact switch	Adjust tension of springs
	Short contact spring (9) fig. 30 too far from long contact spring (3)	Reset adjusting eccentric
	Lower actuating plate of shutter brake does not close contacts of main contact switch (4) fig. 4-15	Readjust, clean and lubricate brake assembly
Scratches on emulsion side of film.	Film tracks rough	Hone tracks
	Curved bracket (38) fig. 35 too high	Readjust or replace bracket
	Insufficient tension of compensating friction clutch. fig. 1-2	Adjust tension

MALFUNCTION	PROBABLE CAUSE	REMEDY
Scratches on back of film.	Foreign matter on pressure plate (3) fig. 23	Clean pressure plate
	Damaged or scratched pressure plate	Replace pressure plate
Image on film unsharp.	Rangefinder out of adjustment	Readjust rangefinder
	Lens flange-to-focal plane distance incorrect	Adjust distance
	Lens flange not parallel with film tracks	Adjust lens flange or film tracks
	Note: Lens flange-to-focal plane distance and par parallity must be correctly adjusted before troubleshooting rangefinder.	
Rangefinder does not indicate correct distance.	Roller arm, fig. 4-27, out of adjustment	Adjust eccentric cam "A" and eccentric shaft
	Roller arm, fig. 4-27, bent	Straighten roller arm
Rangefinder roller arm does not follow lens focusing cam.	Objective lever tension spring (7) fig. 26 disengaged	Re-engage spring
	Objective lever (13) fig. 26, ballbearing pivots too tight	Readjust bearing tension or relubricate
Rangefinder movable image only visible in viewfinder.	Beam splitting prism separated	Replace range-viewfinder assembly
Viewfinder field dark.	Beam-splitting prism, separated	Replace range-viewfinder assembly
Bright-line frames have hair lines.	Glass plates (6) fig. 27, decemented	Replace frame assembly
Bright-line frame does not move or position correctly when lens is mounted on camera or when roller arm or frame selector is actuated.	Glass plate mount spring (3) fig. 27 disengaged	Reengage spring
	Metal mask spring (1) fig. 27 disengaged	Reengage spring
	Foreign matter between bright-line frame carrier and glass plate mount (4) fig. 27	Remove foreign matter
	Foreign matter between metal mask (7) and glass plate (6) fig. 27	Remove foreign matter

Section II. EXPOSURE METER

2–2. General

Malfunctioning of a photo-resistor exposure meter may be divided into three categories; mechanical, electrical, or fatigue of the CdS cell.

a. Mechanical malfunctions are generally obvious, and a careful examination of the meter will usually reveal the cause.

b. Electrical malfunctions require tracing the circuit with a multi-meter, checking resistors, and contacts.

c. The cadmium sulfide photo-resistor is adversely affected by prolonged exposure to an intense source of light. Its "memory" may result in incorrect or eratic meter readings. If the CdS cell is a suspected source of trouble, the meter should be protected from light for a period of 12-hours before checking the circuit electrically.

d. Troubleshooting Chart.

MALFUNCTION	PROBABLE CAUSE	REMEDY
Needle does not reach test dot	Battery voltage too low	Replace battery
Needle goes beyond test dot	Wrong battery (Voltage too high)	Replace battery
	Test resistors have open circuit or changed value	Replace test resistors
Sluggish reading	Pivots of movement defective	Replace meter circuit insert
	Foreign matter	Clean
Coupling wheel does not turn	Broken gear	Replace gear
Coupling wheel does not turn speed dial of camera	Broken coupling pin	Replace pin
No reading	Exhausted battery	Replace battery
	Open circuit in coil assembly	Replace meter circuit insert
	Short in coil assembly	Removing short
	Bad switch contact	Clean and repair switch
Erratic reading	Bad contact of release button	Clean and repair release button contact
	Bad contact of battery test switch	Clean and repair test switch contact
	Tension of contact spring too soft	Tension springs
Needle does not reach zero or calibration point	Maladjusted	Readjust with adjusting screw
		If adjustment not possible replace CdS cell

2–3. General

The photographic effects of lens malfunctions are listed in TM 11–6720–244–12, paragraph 4-8. Mechanical malfunctions are detailed in paragraph *b* below.

a. Malfunctions. Mechanical malfunctions are generally obvious. Poor optical performance may require photographic testing to establish the cause. All lenses should be checked photographically after being repaired.

b. Troubleshooting Chart.

MALFUNCTION	PROBABLE CAUSE	REMEDY
	35mm Lens (fig. 42)	
Fits too loosely in camera	Damaged bayonet mounting lugs	Replace helical focusing assembly (25)
	Locking slot damaged	Replace helical focusing assembly (25)
Fits too tightly in camera	Damaged bayonet mounting lugs	Replace helical focusing assembly (25)
	Burrs on base of lens or bayonet mounting lugs	Remove burrs by honing
Positions other than 35mm bright-line frame	Bayonet lug engaging frame selector damaged	Replace helical focusing assembly (25)
	Locking slot damaged	Replace helical focusing assembly (25)
Rangefinder image jumps when focusing lens	Burrs on rangefinder cam of helical focusing assembly (25)	Remove burrs by honing
Rangefinder images do not coincide at infinity	Damaged bayonet mounting lugs	Replace helical focusing assembly (25)
	Burrs on base of lens	Remove burrs by honing
Focusing ring can be rotated without focusing lens	Loose retaining ring (19)	Tighten retaining ring
Incorrect f/stop indexing	Loose retaining ring (5)	Tighten retaining ring
	Loose retaining ring (10)	Tighten retaining ring
Buckled diaphragm blades	Dirty diaphragm blades	Clean diaphragm blades
	Damaged diaphragm blade	Replace damaged diaphragm blade
	50mm Lens (fig. 43, 44)	
Fits too loosely in camera	Damaged bayonet mounting lugs	Replace helical focusing assembly (6), fig. 44
	Locking slot damaged	Replace helical focusing assembly (6)

MALFUNCTION	PROBABLE CAUSE	REMEDY
Fits too tightly in camera	Damaged bayonet mounting lugs	Replace helical focusing assembly (6)
	Burrs on base of lens or bayonet mounting lugs	Remove burrs by honing
Positions other than 50mm bright-line frame	Bayonet lug engaging frame selector damaged	Replace helical focusing assembly (6)
	Locking slot damaged	Replace helical focusing assembly (6)
Rangefinder image jumps when focusing lens	Burrs on rangefinder cam of helical focusing assembly (6)	Remove burrs by honing
Rangefinder images do not coincide at infinity	Damaged bayonet mounting lugs	Replace helical focusing assembly (6)
	Burrs on base of lens	Replace burrs by honing
Focusing ring can be rotated without focusing lens	Loose retaining ring (16), fig. 43	Tighten retaining ring
Incorrect f/stop indexing	Loose set screw (4)	Tighten set screw
	Loose set screws (6)	Tighten set screws
Buckled diaphragm blades	Dirty diaphragm blades (12)	Clean diaphragm blades
	Damaged diaphragm blade (12)	Replace damaged diaphragm blade
	135mm Lens (fig. 46, 47, 48)	
Fits too loosely in camera	Damaged bayonet mounting lugs	Replace bayonet ring (3), fig. 47
	Locking slot damaged	Replace bayonet ring (3)
Fits too tightly in camera	Damaged bayonet mounting lugs	Replace bayonet ring (3)
	Burrs on base of bayonet ring or mounting lugs	Remove burrs by honing
Positions other than 90mm bright-line frame	Bayonet lug engaging frame selector damaged	Replace bayonet ring (3)
	Locking slot damaged	Replace bayonet ring (3)
Rangefinder images do not coincide at infinity	Damaged bayonet mounting lugs	Replace bayonet ring (3)
	Burrs on base of bayonet ring	Remove burrs by honing
	Loose screws (2)	Tighten screws
	Bent coupling in differential cam assembly (8)	Straighten to 6.5mm from base of bayonet ring (3)
	Viewing unit incorrectly collimated (fig. 48)	Collimate viewing unit
Incorrect f/stop indexing	Loose set screws (9), fig. 46	Tighten screws
	Loose set screw (13)	Tighten screw
Buckled diaphragm blades	Dirty diaphragm blades (20)	Clean diaphragm blades
	Damaged diaphragm blade (20)	Replace damaged diaphragm blade

2–4. General

The photographic effects of flash unit malfunctions are listed in the troubleshooting chart (par. 4–8) of the KS–15(4) Operator's Manual TM 11–6720–244–12.

a. Mechanical malfunctions are generally obvious and their remedy self-evident.

b. Electrical malfunctions usually require checking with a multimeter. The procedures are outlined in paragraph 5–3*c* of TM 11–6720–244–12.

c. Troubleshooting Chart.

MALFUNCTION	PROBABLE CAUSE	REMEDY
Reflector won't open	Defective segment cleat	Replace cleat
Reflector won't close	Segments damaged or bent cleat	Replace damaged segment or cleat
Reflector will not lock in open position	Upper segment damaged Lower segment damaged	Replace segment Replace segment
Reflector handle loose or tight in mounting bracket	Mounting bracket damaged Pressure spring damaged	Repair or replace bracket Replace pressure spring
Bayonet-base bulb will not stay in socket	Spring broken or weak	Replace spring
Bayonet-base flash bulbs will not eject	Release spring too tight Contact spring broken	Adjust spring Replace spring
Mounting foot loose	Loose or missing screws Bottom block broken	Tighten or replace screws Replace bottom block
Flash bulb fires when inserted in socket	Connecting cord shorted Shorted resistor	Replace connecting cord Replace resistor
Flash bulb will not fire	Battery reversed Battery exhausted Connecting cord open Capacitor defective Rectifier defective	Reverse polarity Replace battery Replace connecting cord Replace capacitor Replace rectifier
Capacitor will not charge	Defective capacitor Defective resistor Battery exhausted	Replace capacitor Replace resistor Replace battery

CHAPTER 3

DISASSEMBLY

Section I. CAMERA BODY

3–1. General

In so far as possible the cause of the malfunctions should be identified before disassembling the camera. Seldom must a camera be completely taken apart for repair. Disassembly should not be carried further than is necessary to correct the determined malfunction. To do so will disturb other adjustments. The identity, location and position of all parts should be noted as they are removed, and replaced in the same position when reassembling. Many parts are not directly interchangeable but must be fitted individually. All subassemblies can be taken apart, but in many cases it is advisable to replace the entire subassembly rather than to attempt to repair it. An example is the range-viewfinder assembly. This is an intricate mechanism and, if taken apart, would require the use of special collimators for realignment. Components which are riveted, sweated or press fitted should be replaced as assemblies. This is especially true of optical elements which are cemented.

3–2. Baseplate Disassembly

(Fig. 22)

a. Remove baseplate from camera.

b. Remove screw (1).

c. Lift off film positioning disc.

d. Remove screw (3) and washer (4).

e. Lift off locking plate (5) and washers (6, 7 and 8).

f. Remove lock stud assembly (11, 12 and 13) with washer (10).

g. Remove pin (13) from lock stud (11) and handle (12).

3–3. Hinged Back Disassembly

(Fig. 23)

a. Remove hinged back from camera by pushing locking pin assembly (7, 8 and 9) to the side.

b. Remove actuator (7) with tool 42–253.01–571W1.

CAUTION: Hold locking pin with finger when removing actuator.

c. Remove 4 screws (1).

d. Remove two angle plates (2).

e. Disengage pressure plate (3) from spring (4).

3–4. Top Plate Removal and Disassembly

(Fig. 21, 24)

a. Removing Top Plate From Camera Body (fig. 21).

(1) Remove body cover (3).

(2) Remove two flash socket covers (4).

(3) Remove screw ring (6) with tool 42–253.01–36W4.

(4) Lift off saddle spring (7), winding lever (8), spacer (9) and counting dial (10).

NOTE: Spacer (9) is not on all cameras.

(5) Remove felt ring (11).

NOTE: Felt ring is glued on top plate. Remove only if damaged.

(6) Remove screw (12) with tool 42–582.01–27W1.

(7) Remove screw (13) from speed dial (14).

(8) Lift off speed dial (14).

(9) Remove 4 screws (15) from accessory clip (17).

(10) Remove stop screw (16) from accessory clip (17).

NOTE: Remove screw only if damaged.

(11) Lift off accessory clip (17) with pressure plate (18) and spring (19).

(12) Remove screw (20) with tools 42–253.01–494W4 and 42–253.01–80W8.

(13) Lift off washer (21) and rewind knob (22) with slotted sleeve (23) and carrier (24).

(14) Remove retaining ring (25) with tool 42–253.01–498W2.

(15) Remove 2 flash socket cover rings (26) with tool 42–253.01–486W1.

(16) Remove 2 flash socket bushings (27) with tool 42–253.01–483W8.

(17) Remove 2 locking springs (28).

NOTE: Remove springs only if damaged.

(18) Remove sealed screw (29).

NOTE: Seal must be removed to provide access to screw.

(19) Remove top plate (5).

(20) Lift off saddle spring (30), release knob and shaft (31) and release sleeve (32).

b. Disassembly of Top Plate (fig. 24).

(1) Remove screw (1).

(2) Remove cemented window (2).

(3) Remove holding bracket (5).

(4) Remove cemented illuminating window (3).

(5) Remove cemented window (4).

(6) Remove eyelens (6) with tool 42–253.01–36W4.

NOTE: Remove windows and eyelens only if damaged.

3–5. Range-Viewfinder Assembly Removal and Disassembly

(Fig. 25, 26, 27)

a. Removing Range-Viewfinder Assembly (fig. 25)

(1) Remove 2 screws (2), 2 screws (3) and screw (4). Lift off cover plate (5) and locking bar (6) with spacer (7).

NOTE: Spacer (7) is not on all cameras.

(2) Remove cover plate (8) with tool 42–253.01–804W2.

(3) Remove screw (9) with tool 42–253.01–630W6 and washer (10).

(4) Remove roller arm (11) with cam (12).

(5) Remove stop arm (13).

(6) Remove screw (14) with eccentric nut (15) using tool 42–253.01–114W1.

(7) Lift range-viewfinder assembly (1) off inner housing.

(8) Remove plastic washer (16) and plastic plate (17).

b. Partial Disassembly of Range-Viewfinder Assembly (fig. 25, 26, 27).

(1) Remove cemented light shields (18) and (19), fig. 25.

(2) Remove 2 screws (1), fig. 26, and lift out bright-line frame assembly (2).

(3) Remove spring (1), fig. 27 and screw (2) with spring (3).

(4) Lift glass plate mount (4) with glass plate (6) and metal mask (7) from mask carrier (8).

3–6. Removing Inner Housing from Outer Housing

(Fig. 28)

a. Fully wind delayed action release clockwork by turning delayed action lever counterclockwise.

b. Remove screw (2) and pull off reverse lever (3).

c. Loosen screw (12) with tool 42–253.01–637W5 and push frame selector lever (13) clockwise to uncover screw (4).

d. Remove 4 screws (4).

e. Remove screw (5) and lift inner housing (14) out of outer housing (11).

3–7. Removing Lens Mounting Flange from Outer Housing

(Fig. 39)

a. Remove screw (15) and lift off lens lock (16).

b. Remove 4 screws (22) and lift off flange (23).

c. Remove 4 screws (24) and spring ring (25).

3–8. Disassembly of Inner Housing

a. Removing Main Light Shield (fig. 28).

(1) Remove 2 screws (6) and screw (7).

(2) Lift out main light shield (8).

b. Removal and Partial Disassembly of Delayed Action Release Clockwork (fig. 28, 29).

(1) Remove ▮ screws (9), fig. 28 and lift off clockwork mechanism (10).

(2) Unhook spring (1), fig. 29 from stud (23).

(3) Unhook spring (1) from spring carrier (3), and remove spring.

c. Disassembly of Synchronizing Circuit Components (fig. 30, 31).

(1) *Electronic flash circuit* (fig. 30).

(a) Remove screw (17) and lift up terminal frame (18) with grounding plate (24).

(b) Desolder wire (16) from terminal (25), and wire (11) from grounding plate (24).

(c) Desolder wire (16) from long contact spring (8), and wire (11) from guide spring (14).

(d) Lift out metal tube (15) with wires (11) and (16).

(e) Remove nut (12) with tool 42–253.01–338W2, screw (13) and guide spring (14).

(f) Remove 2 screws (1) and lift off insulating plates (2) and (4) and long contact spring (3).

(g) Remove 4 screws (5) and lift off metal plate (6), upper insulating plate (7), insulating shield (8), short contact spring (9), and lower insulating plate (10).

(2) *Flash bulb circuit* (fig. 30, 31)

(a) Remove screw (17), fig. 30 and lift up terminal frame (18) with grounding plate (24).

NOTE: This paragraph does not apply if the disassembly procedure described in paragraph *c*(1)(*a*) above was carried out.

(b) Desolder wire (22) from terminal (29) and from contact spring (21).

(c) Desolder ground wire (9), fig. 31, from bearing plate (8) and from contact arm (29).

(d) Remove 2 screws (19), fig. 30, and lift off insulating plates (20) and (23) and contact spring (21).

(e) Remove screw (26) and spring (27). Lift out synchro adjusting lever (28).

d. Removal and Disassembly of Rewind Assembly (fig. 31).

(1) Remove 2 screws (1), sleeve (2) and bearing assembly (3).

(2) Remove rewind shaft (5) and washer (4) from bearing assembly.

(3) Remove gear (6) from rewind fork (7), with tools 42–253.01–79W4 and 42–253.01–80W8.

e. Removing Slow Speed Escapement (fig. 31).

(1) Remove threaded shaft (14).

(2) Remove spring (15).

(3) Lift out slow speed escapement (16).

f. Removal and Disassembly of Drive Shaft Assembly (fig. 31, 34).

(1) Remove 3 screws (42), fig. 31, and lift off drive shaft assembly (41).

(2) Unhook spring (1), fig. 34, and lift out pawl (2).

(3) Remove screw (3) and spring (1).

(4) Remove "C" clip (4), spacer washers (5), drive shaft gear (6), ratchet plate (7), washer (8) and spring (9).

(5) Remove carrier sleeve (10), spring (11), carrier disc (12) and washer (13).

(6) Lift out drive shaft (14) and remove ratchet gear (15) from drive shaft bearing plate (16)

g. *Removal of Shutter Bearing Plate Assembly* (fig. 31).

(1) Remove "C" clip (10) from shaft (45) and push shaft down to clear bearing plate assembly (8).

(2) Remove screw (11) and sleeve (12).

(3) Remove 2 screws (13) and lift off bearing plate assembly (8).

(a) Removal of components disjoined from shutter bearing plate assembly.

1. Remove washer (17), adjusting lever assembly (20), washer (21) and spacer sleeve (22).

2. Remove spring (23), spacer ring (24), washer (25) and stop lever (26).

3. Remove double stop lever (43) with shaft (45) and spring (44).

h. *Removal of Shutter Release Components* (fig. 31, 35).

(1) Remove screw (31), fig. 31, holding plate (32), spring (33) and lift out arresting lever "B" (34) with insulating cap (35).

(2) Remove release shaft (1), fig. 35, and release rod (2).

(3) Remove screws (18) and (19) and flat spring (20).

(4) Remove 2 screws (23), partially pull out intermediate gear shaft (24) and remove intermediate gear (25) and washer (26). Remove intermediate gear shaft and arresting lever "A" (27) with spring (28).

i. *Removal and Disassembly of Take-Up Spool Assembly* (fig. 35).

(1) Remove "C" clip (3), washer (4) and take-up spool assembly.

(2) Remove spacer washer (6).

(3) Remove spring (9) with tool 042–782.001–001ZW2.

(4) Remove screw (7), spring (10), bushing (11) with washer (8), and take-up spool (12).

(5) Remove holding shaft (13) with tools 42–782.001–162W1 and 42–782.001–161WNY, release disc (14) and gear (5).

j. *Partial Disassembly of Intermediate Gear Assembly* (fig. 35).

(1) *CAUTION:* Prevent spring from dislodging when removing "C" clip.

Remove "C" clip (40).

(2) Lift off washer (41), spring (42), locking lever (43), and intermediate gear (44).

k. Removal and Partial Disassembly of Sprocket Wheel Assembly (fig. 35).

(1) *CAUTION:* Stop disc retaining nut and sprocket wheel shaft have left hand threads.

Remove stop disc retaining nut (29) with tool 42–253.01–31W3 and lift off stop arm (30) and stop disc (31).

(2) Remove screw (32) and lift off gear (33) and washer (36).

(3) Remove screw (34), pull out shaft (35) and remove washer (48).

(4) Remove 2 screws (37), lift off curved bracket plate (38) and sprocket wheel (39).

l. Removal and Disassembly of Brake Assembly (fig. 36, 37).

(1) Remove screws (1), fig. 36, and (2) and lift out brake assembly (3).

(2) Remove "C" clip (1), fig. 37, from shaft "B", lift off spring (2) and brake shoe (3).

(3) Remove eccentric nut (4) with tool 42–582.01–273W3 and pull out shaft (5) with spring washer (6) and washer (7).

(4) Remove bushing (8) with tool 42–253.01–320W2 and spacer (9).

(5) Remove screw (10) from shaft "A" and lift off spring washer (11), upper actuating plate (12), friction washers (13) and (14), brake disc (15), lower actuating plate (16), and friction washer (17) .

m. Removal of Shutter Curtain Assembly (fig. 38).

(1) Remove 2 shutter tension adjusting bearings (4) with tool 42–253.01–U257W3.

(2) Lift out shutter curtain assembly (9).

n. Disassembly of Shutter Curtain Assembly (fig. 38).

(1) Remove 2 screws (1) and curtain holding bar (2).

(2) Remove second shutter curtain (18) from main roller (5), and second shutter curtain ribbons from ribbon spring roller (17).

(3) Remove first shutter curtain (19) from first curtain spring roller (11).

(4) Remove first shutter curtain ribbons from main ribbon rollers.

(5) *CAUTION:* Tensioning studs (6) and (12) have left hand thread.

Remove tensioning stud (6) from spring roller assembly shaft (10).

(6) Remove 2 "C" clips (7), 2 washers (8) and 2 ribbon guide rollers (9).

(7) Remove spring roller shaft assembly (10) with tool 42–253.01–246NY.

(8) Remove tensioning stud (12) and washer (13) from spring roller assembly shaft (16).

(9) Remove 2 "C" clips (14) and washer (15).

(10) Remove spring roller shaft assembly (16) with tool 42–253.01–246NY.

Section II. EXPOSURE METER

3–9. General

Do not disassemble the exposure meter beyond that necessary to make the repair. Disassembly of the meter movement, or printed circuit assembly, is not authorized. If these components are damaged, replace the entire meter circuit insert.

3–10. Disassembly of Housing

(Fig. 40)

a. Remove retaining screw (1) from exposure meter assembly (2) with tool 3.719.004.01/5W1NY.

b. Remove aperture dial (3) with spacer washers (4) and (5).

c. Remove speed dial (6).

d. Remove plastic washer (7) from housing (10).

NOTE: Remove plastic washer (7) only if damaged.

e. Remove 2 screws (8) and 2 screws (9).

f. Push battery test switch in the direction of its arrow, and remove housing (10) from insert (13).

g. Remove washer (11).

h. Unhook spring (12).

3–11. Disassembly of Switches and Gear System

(Fig. 41)

a. Set coupling knob (21) to "B" position.

b. Slide out battery test switch (1) through its slot in insert (2).

c. Remove screw (3), washer (4) and spacer (5).

d. Remove switch arm (6), spacer washer (7) and insulating washer (8).

e. Remove screw (9), washer (10) and gear (11).

f. Remove washer (12) and nose washer (13).

g. Remove 2 screws (14).

h. Lift off sector-gear assembly (15).

i. Remove "C" clip (16) and washer (17).

j. Lift off gear (18) from mounting plate (19).

k. Remove spring (20).

l. Remove coupling knob (21).

NOTE: To remove coupling knob (21), remove mounting foot and battery cover (see (see TM 11-6720-244-12, fig. 5-2).

Section III. LENSES

3-12. General

Do not disassemble a lens beyond the point necessary to make the repair. Scribe mating parts (except optical components) to assure proper positioning when reassembling.

3-13. Disassembly of 35mm Lens

(Fig. 42)

a. Remove fluted tube (3) and serial number ring (4).

b. Remove retaining ring (5).

c. Remove 3 screws (6), front ring (7), and adjustment ring (8).

d. Remove set screw (9), retaining ring (10), and diaphram adjusting ring (11).

NOTE: Hold spring (14) with finger to avoid loss of spring and ball (15).

e. Remove 2 guide screws (12), circle clip (13), and inner ring (16).

f. Disassembly of Diaphram.

(1) Remove rear optical components from lens tube (17).

(2) Remove retaining ring holding front optical components with tool 42–672.01–3–1W1NY, and slide out front optical components.

(3) Remove diaphram guide ring and lift ten diaphram blades from lens tube (17).

g. Remove dowel screw (18) and unscrew retaining ring (19), lift off focusing ring (20) with pressure spring (21) and sliding bar (22).

h. Remove 3 screws (23) and lift off depth-of-field ring (24).

3–14. Disassembly of 50mm Lens Head and Focusing Scale Assembly

(Fig. 43)

a. Unscrew lens mount (3) with index ring (5).

b. Remove set screw (4) and index ring (5) from lens mount (3).

c. Remove 2 set screws (6) and 1 dowel screw from diaphram adjusting ring (7) and remove adjusting ring from lens tube (14).

NOTE: Do not lose flat spring (8) and ball (9) when sliding off adjusting ring.

d. Remove 2 guide screws (10) and lift off inner ring (13).

e. Removal of Diaphram Blades.

(1) Lift diaphram guide ring (11) from lens tube (14).

(2) Remove 10 diaphram blades (12).

f. Lift out cover ring (15) and remove retaining ring (16).

g. Lift off focusing ring (19) with components.

h. Unscrew sleeve (17) and remove spring ring (18) and stop ring (25) with segment (23).

i. Remove 3 screws (22) and segment (23).

j. Remove screw (20) and stop (21).

3–15. Partial Disassembly of 50mm Helical Focusing Assembly

(Fig. 44)

Remove 2 screws (3), segment (4), stop spring (5) and nipple (2).

3–16. Partial Disassembly of 50mm Viewing Unit

(Fig. 45)

Optical components and their mounts are permanently bonded. Disassembly is limited to that required for repair of replaceable parts.

a. Remove 2 screws (12) and finger grip (13).

b. Remove screw (15) and stop (16).

3–17. Disassembly of 135mm Lens Head

(Fig. 46)

a. Remove filter retaining ring (2).

b. Remove retaining ring (3), stop ring (4), inner lens hood tube (5), outer lens hood tube (7), and lens hood liners (6) and (8).

c. Remove stop ring (4) and separate lens hood tubes (5) and (7).

d. Remove 3 set screws (9) and slide off diaphram adjusting ring (10).

NOTE: Take care that flat spring (12) and ball (11) are not lost.

e. Remove set screw (13) and unscrew lens mount (14) from lens tube (21).

f. Remove circle clip (15) and inner ring (16).

g. Removal of Diaphram Blades.

(1) Remove guide screw (17), circle clip (18) and lift out diaphram guide ring (19).

(2) Remove 12 diaphram blades (20).

3–18. Disassembly of 135mm Focusing Mount

(Fig. 47)

a. Remove 2 screws (4), tripod bushing plate (5), and screw (6).

b. Unscrew coupling ring (located between viewing unit assembly (7) and depth-of-field ring (13)) using tool C42–37.01–U60T6. Slide off helical focusing assembly (14).

c. Remove 6 screws (2) and bayonet ring (3) and lift differential cam assembly (8) from viewing unit (7).

d. Remove screw (9), nut (10), and stop (11).

e. Remove retaining ring (12) with tool 42–37.01–U60W3NY.

f. Remove depth-of-field ring (13) from helical focusing assembly (14).

3–19. Partial Disassembly of 135mm Viewing Unit

(Fig. 48)

Optical components and their mounts are permanently bonded, except element (15). Disassembly is limited to that required for repair of replaceable parts.

a. Remove 2 cover screws (1).

b. Remove 4 screws (2), 3 screws (3), and cover plate (4).

c. Remove 1 screw (6), retaining plate (7), and pressure spring (8).

d. Loosen [redacted] adjusting screws (13) and remove flat spring (14) and optical element (15).

Section IV. FLASH UNIT

3–20. Disassembly of Reflector

(Fig. 49)

a. Remove screw (3).

b. Remove ring nut (2) with tool 42–471–117W3NY.

c. Turn lower reflector segment (8) slightly, and slip the segment cleat out of the slot.

d. Remove the segment cleat from the reflector segment adjacent to segment (8).

e. Repeat the procedure in *d* above until segment cleats have been removed from all reflector segments.

3–21. Disassembly of Bayonet-Base Lamp Adapter

(Fig. 50)

a. Remove 3 screws (2) and slide bayonet socket shell (3) off intermediate sleeve (6).

b. Remove ejector button (4) and release spring (5).

c. Pull intermediate sleeve (6) off socket inner sleeve (9).

d. Remove screw (7) and contact pin (8).

3–22. Disassembly of Medium-Base Lamp Socket

(Fig. 50)

a. Press contact spring assembly (10) and retaining ring (11) from medium screw-base lamp socket.

b. Remove the upper contact cap from the spring of the contact spring assembly, and remove the spring.

3–23 Disassembly of Battery-Capacitor Insert

(Fig. 51)

a. Remove round nuts (3) and (9) with tool 42–471–296W4NY.

b. Remove 4 screws (1).

c. Desolder lead of capacitor (18) from lug (16) on upper plate assembly (4) and remove upper plate.

d. Slide lower plate assembly, with attached components, from B–C housing (5).

e. Disassemble lower plate assembly only as far as necessary to replace defective components.

3–24. Disassembly of Flash Unit Housing

(Fig. 52)

a. Remove 2 screws (1), retaining plate (2), reflector mounting bracket (3), and pressure spring (

b. Remove 3 screws (5) and slide bottom block (19) from battery housing (6).

c. Remove screw (7), contact plate (8), rectifier (9), and contact spring (10).

d. Remove screw (11), insulating strip (12), wide contact clip (13) with contact strip (14), narrow contact clip (15), and contact wire (16).

e. Remove 3 screws (17) and mounting foot (18).

CHAPTER 4

REPAIR AND ALIGNING

Section I. CAMERA BODY

4–1. General

In so far as possible, determine the repairs to be made before disassembling the camera. Reference to chapter 2 (troubleshooting) will assist in isolating the component requiring repair or adjustment. Disassembly beyond that necessary to make the repair or adjustment should be avoided. In most instances, sub-assemblies become accessible by removing the top plate (par. 3–4), range-viewfinder assembly (par. 3–5, and taking the inner housing from the outer housing (par. 3–6). Worn or damaged parts should be replaced before reassembling the camera.

4–2. Cleaning

WARNING: Most cleaning compounds are flamable and toxic. Do not use near an open flame. Provide adequate ventilation.

CAUTION: All components should be removed from the camera body before cleaning. Cleaning without removal may damage other components. Some sub-assemblies, after removal, may be cleaned without disassembling them. All lubricants and adhesives must be removed from components before relubricating or cementing. After cleaning, thoroughly dry the part by wiping or using compressed air.

The cleaning materials required are listed in TM 11–6720–244–12 (par. 5–25) plus the following:

MATERIAL	TYPE	USE	SYMBOL
Thinner	Terokal D	To thin Tereson glue and cleaning	O
Thinner	MB	To thin adhesive 880 and cleaning	P
Thinner	859–FV	To thin adhesive 859–F and cleaning	Q
Thinner	Atlas 500	To thin adhesive 500 and cleaning	R
Benzine	Liquid	To clean metal parts	S
Detergent	Soap free powder dissolved in water	To clean top plate windows	T
Lens Cleaner	Kodak	To clean optical parts	U

4–3. Lubrication and Gluing

a. Lubricants and Adhesives. The lubricants and adhesives used for repair of the KS–15(4) Camera Set are listed below. They are, in most cases, special compounds and substitutes should not be

used. The symbol in the "Adhesive or Lubricant" column of the figure legends (part 2) identify the type and method of application. The first symbol is the type of adhesive or lubricant, and the symbol after the dash indicates the method of application.

CAUTION: Do not use excessive amounts of adhesives or lubricants. Do not permit them to contact exposed optical elements. Do not permit lubricants to contact shutter curtains or ribbons. Do not permit adhesives to contact shutter curtains or ribbons on areas other than specified.

MATERIAL	LEITZ NUMBER	TYPE	SYMBOL
Heavy grease	300	Losimol Magunna type 1150-A	A
Medium grease	460	Klüber type VP–2	B
Ball bearing oil	601	Bendix Navigation and Control 10–PD14926–52	C
Light grease	602	Klüber PDP–38 (95%) plus Alugel (5%)	D
Light grease	618	Ernst Leitz, GmbH	E
Medium grease	704	Shell #7 (95%) plus MoS2 microfine (5%)	F
Medium grease	340	Losimol Magunna type BO–4/4	G
Medium grease	428	Klüber type LDS–18 heavy	H
Adhesive	880		I
Glue		Tereson	J
Adhesive	859		K
Adhesive	500	Atlas plastic adhesive	L
Wax	637		M
Cement		Duco	N

b. Methods of Application.

SYMBOL	*METHOD*
B	*Brush application*
F	*Finger application*
S	*Syringe*
T	*Toothpick application*

4–4. Shutter Curtain Assembly

(Fig. 4–1, 4–2)

When replacing shutter curtains, or ribbons, do not disassemble the camera beyond that necessary to make the replacement.

a. Replacing Second Shutter Curtain and Ribbons. If both curtains are to be replaced, the second curtain should be replaced first. Do not remove the complete assembly from the inner housing (par. 3–8*n* (1) and (2).

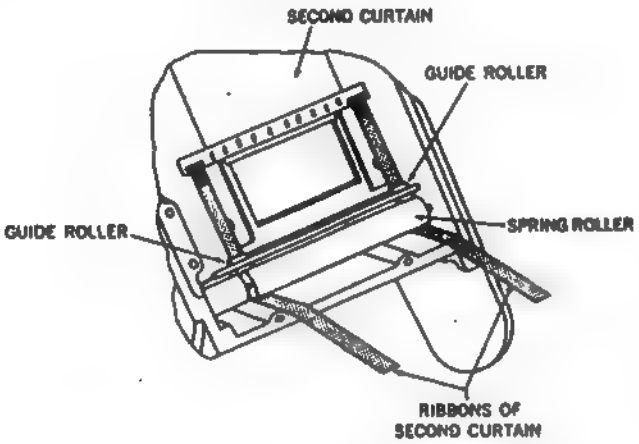

Figure 4–1. Positioning Second Curtain Ribbons.

CAUTION: The ribbons of the second curtain replacement should be cut to the same length as the removed curtain ribbons.

(1) Thread the ribbons under the guide rollers and under (behind) the second curtain spring roller (fig. 4–1).

(2) Glue the ends of the ribbons on the second curtain spring roller.

(3) Tension the second curtain spring roller until the metal bar of the first curtain engages the labyrinth of the second curtain.

(4) Thread the second shutter curtain under the second curtain roller, and rotate the roller to its released position (holding bar slot on top).

(5) Align the slots in the shutter curtain with the holding bar mounting holes. Secure the curtain to the roller by mounting the holding bar (fig. 38).

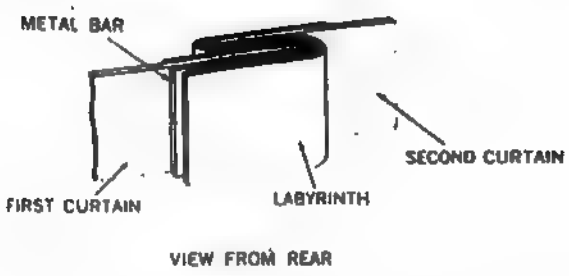

Figure 4–2. Position of Curtain Bar and Labyrinth.

(6) Wind the shutter about half-way. The crimped edge of the first curtain bar should extend for approximately 0.7mm outside the second curtain labyrinth, when viewed from the rear (fig. 4–2).

(7) Rotate the second curtain roller with the thumb until a narrow slit is visible between the first and second curtain. The edges of the curtains must be parrallel to each other.

(8) If the edge of the second curtain is not parallel with the first curtain, reglue one of the second curtain ribbons.

(9) Wind the shutter, set the shutter speed dial to "B", and release the first curtain. Hold the shutter release button in the depressed position.

(10) Check the position of the second shutter curtain, using gauge 42–253.01–Z1A92. The edge of the curtain should be between 3.05mm and 3.55mm from the edge of the film apertu

(11) If the edge of the second curtain is not within the tolerences in (10) above, reposition the curtain. Loosen the two screws of the holding bar, move the curtain, and retighten the screws.

(12) Release the tension of the second curtain spring roller until the ribbons are slack. Allow 12-hours for the glue to dry before retensioning the spring.

(13) Retension the second shutter curtain spring roller, and adjust the shutter speeds as described in paragraph 4–8.

b. Replacing First Shutter Curtain and Ribbons (fig. 1–2, 36, 38).

(1) Lift the metal tube, which carries wires of the synchronizing circuit, and move it slightly to the side.

(2) Remove the adjusting bearing (4), fig. 36 of the first curtain spring roller assembly with tool 42–253.01–257W3.

(3) Take the spring roller assembly (B–1) from the inner housing, and remove the shutter curtain (19) fig. 38 from the roller.

(4) Remove the first shutter curtain ribbons from the ribbon rollers of the main roller assembly (fig. 1–2).

(5) Glue the replacement curtain on the first curtain spring roller assembly.

(6) Replace the spring roller assembly, with the curtain, in the inner housing and install the adjusting bearing with tool 42–253.01–257W3.

(7) Tension the first curtain roller slightly, and thread the curtain ribbons under the main roller assembly. Bring them around the first curtain ribbon rollers. The ribbons pass underneath (rear side) of the second shutter curtain labyrinth.

(8) Glue the ribbons to the first curtain ribbon rollers, and check parallelity of the curtain edges as described in paragraph *a* (7) above.

(9) If the edge of the first curtain is not parallel with the second curtain, reglue one of the first curtain ribbons.

(10) Release the tension of the first curtain spring roller until the ribbons are slack. Allow 12-hours for the glue to dry before retensioning the spring.

(11) Retension the first shutter curtain spring roller, and adjust the shutter speeds as described in paragraph 4–8.

4–5. Shutter Brake Assembly

(Fig. 37, 4–3)

a. Checking.

(1) Wind the camera shutter, set the shutter speed dial to "B", and release the shutter.

(2) Grasp the second shutter curtain with the thumb and forefinger, and pull it in the direction of its travel. The curtain should move an additional 0.1mm to 0.5mm.

(3) Wind the shutter, set the speed dial to "B", and release the first curtain. Hold the shutter release in the depressed position. The edge of the first shutter curtain should be between 1.5mm and 2.5mm beyond the edge of the film aperature.

b. Adjusting

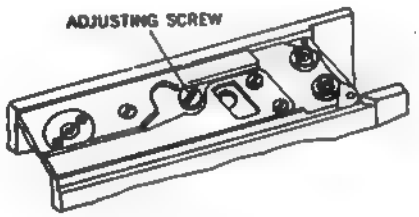

Figure 4–3. Brake Adjusting Screw.

(1) If the positions of the curtains do not meet the requirements of (2) and (3) above, reset the adjusting screw (fig. 4–3).

(2) If the brake cannot be adjusted by resetting the adjusting screw, correct the tension of spring (2), figure 37.

(3) *CAUTION:* The shutter must be wound before replacing the brake assembly.

Replace the brake assembly if it cannot be adjusted by setting the adjusting screw, or correcting the spring tension.

4–6. Driveshaft Assembly

(Fig. 4–4, 4–5, 4–6, 1–10, 35)

CAUTION: The camera shutter must be wound before installing the driveshaft assembly.

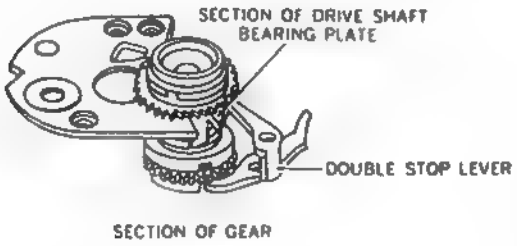

Figure 4–4A. Drive Shaft Assembly.

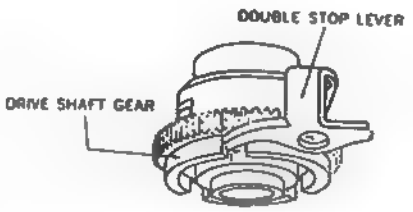

Figure 4–4B. Drive Shaft Gear.

a. Position the driveshaft gear to align one of its cut-out sections with the cut-out in the driveshaft bearing plate (fig. 4–4 "A").

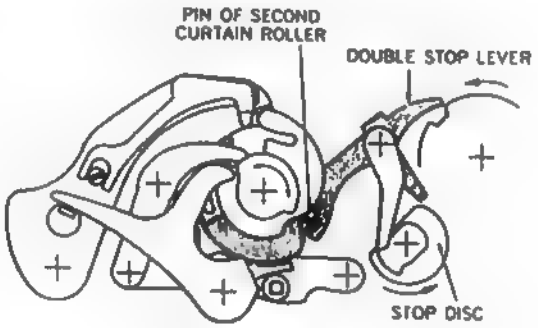

Figure 4–5. Double Stop Lever, Released Position (Top rear view).

b. Position the driveshaft assembly over its mounting holes on the inner housing, while pushing back slightly on the upper end of the double stop lever (fig. 4–5).

c. Align release disc (14), fig. 35 with tool 42–782.001–161WNY, and simultaneously engage the eccentric pin with the counting pawl (fig. 1–10).

d. Hold the driveshaft gear assembly to the inner housing by installing one screw, and tightening it slightly.

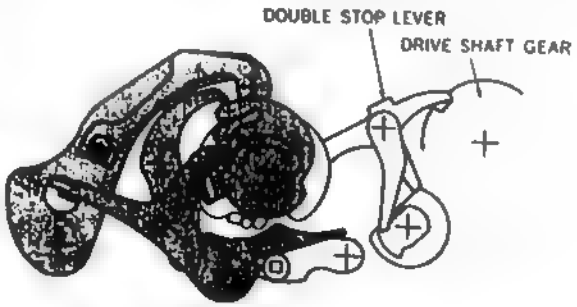

Figure 4–6. Double Stop Lever, Wound Position (Top rear view).

e. Wind and release the shutter. Observe that the lower portion of the double stop lever engages the driveshaft gear, as illustrated in figure 4–4 "B"; and that the upper portion rests against the stop disc, as illustrated in figure 4–6. The pawl (fig. 1–10) must engage the teeth of the ratchet gear when the shutter is fully wound or released.

f. Secure the driveshaft gear assembly by installing the remaining two screws. Tighten all three screws.

g. Replace the driveshaft gear if it is damaged.

4–7. Adjusting Release Mechanism

(fig. 21, 35)

a. Install release sleeve (32), fig. 21, with release knob (31), winding lever (8), saddle spring (7), and screw ring (6).

b. Wind the camera shutter, rest gauge 42–253.01–Z1L74 on the screw ring, and depress the center shaft of the gauge. The shutter must release.

c. If the shutter does not release, adjust flat spring (20), figure 35 as follows:

(1) Loosen screw (19) and shift the position of the flat spring until the shutter releases when depressing the center shaft of the gauge.

(2) Retighten screw (19).

d. Wind the shutter and set the shutter speed dial to "B". Depress the shutter release knob approximately 1.5mm. The first shutter curtain should release.

e. Fully depress the shutter release knob, and slowly let it return to its up position. The flat spring should push the release knob, and arresting lever "B", upward and release the second shutter curtain. After release of the second curtain, the release knob and arresting lever "B", should have an additional upward travel of approximately 0.2mm.

f. If the requirements in *e* above are not satisfied, loosen nut (21), fig. 35 and position adjusting screw (22). Retighten the screw.

g. Check the tension of the flat spring with gauge 42–253.01–Z1A22, and adjust by bending the spring.

h. The release mechanism should operate smoothly. Replace the release knob (31), fig. 21, or the release sleeve (32) if they are damaged.

4–8. Adjusting Shutter Speeds

Wind the camera shutter and tension the spring rollers as described in paragraph *a* (5) below. Check the spring tensions with gauge 42–216–Z1W42. The first curtain should be tensioned to read 17 to 18 on the gauge, and the second curtain should be tensioned between 17 and 21.

a. Fast Shutter Speeds (fig. 4–7 through 4–10).

(1) Wind the camera shutter, and set the shutter speed dial to 1/500-second.

(2) Position the speed pattern checking plate 42–253.01–Z1A95 in the film aperture, and place the front of the camera over the opening of the shutter speed checking drum 42–253.01–Z1W100.

(3) Release the shutter, and check the curved pattern of the second shutter curtain against the pattern plate. If the gradient of the curtain curve does not match the pattern on the plate, proceed as follows:

(a) Curtain curve steeper than pattern. Increase tension of the second curtain spring roller. (See paragraph (5) below).

(b) Curtain curve flatter than pattern. Decrease tension of the second curtain spring roller. (See paragraph (5) below).

$\frac{1}{250}$ $\frac{1}{500}$ $\frac{1}{1000}$

Figure 4–7. High Shutter Speed Patterns.

(4) Remove the pattern checking plate from the camera. Wind and release the shutter (still set for 1/500-second) several times. Compare the shutter slit width with the 1/500-second pattern in figure 4–7. The lower part of the slit should be wider than its top. If the slit width does not match the pattern proceed as follows:

(a) Lower part of slit too narrow. Increase tension of the first curtain spring roller. (See paragraph (5) below).

(b) Lower part of slit too wide. Decrease tension of the first curtain spring roller. (See paragraph (5) below).

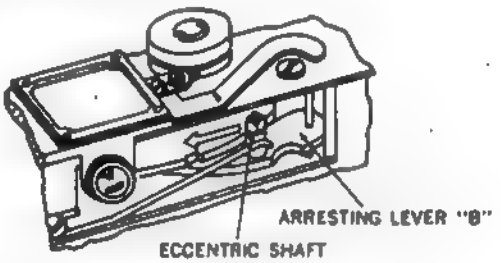

Figure 4–8. High Shutter Speed Adjustment.

(c) Entire slit too wide or narrow. Turn the eccentric shaft of arresting lever "B" (fig. 4–8) to the right or left with tool 42–253.01–U281W3. Reset shutter to 1/250 and 1/1000. Compare slit width with patterns in fig. 4–7.

NOTE: The spring should press against the eccentric shaft with a lateral force of 110 grams + 20 grams, – 0 grams. The downward pressure of the spring against arresting lever "B" should be 130 grams + or – 10 grams.

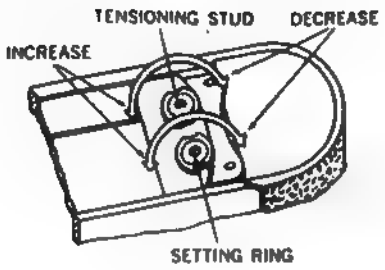

Figure 4–9. Spring Roller Adjustment.

(5) *Adjusting tension of curtain spring rollers* (fig. 4–9).

Insert a screwdriver in the tensioning stud slot and push down on the setting ring. Turning the stud counterclockwise increases tension. Turning the stud clockwise decreases tension. Removing the screwdriver re-engages the setting ring.

(6) Follow the procedures in paragraph (4) above, but reset the shutter speed dial to 1/1000-second.

(7) Release the shutter several times and compare the shutter slit width with the 1/1000-second pattern in figure 4–7. If the slit width does not match the pattern, proceed as follows:

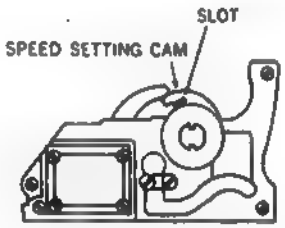

Figure 4–10. Speed Setting Cam for 1/1000-second Adjustment.

(a) Entire slit too wide. Bend the speed setting cam (fig. 4–10) so as to widen the slot.

(b) Entire slit too narrow. Bend the speed setting cam so as to make the slot more narrow.

NOTE: Adjustments (*a*) and (*b*) are seldom required.

b. Slow Shutter Speeds (fig. 4–11, 4–12).

NOTE: The fast shutter speeds must be set correctly before adjusting the slow speeds.

The basic adjustment for the slow speed escapement is 1/8-second. This speed must be set precisely.

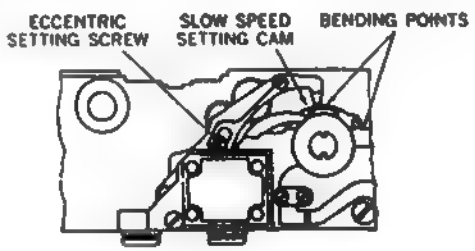

Figure 4–11. Slow Shutter Speed Adjustments.

(1) *Adjusting escapement for 1/8-second* (fig. 4–11).

Turn the eccentric setting screw with a screwdriver until the 1/8-second speed is correct. (see par. *c* below for checking shutter speeds electronically).

(2) *Adjusting slow speed setting cam* (fig. 4–11).

Shutter speeds from 1-second through 1/30-second, with the exception of 1/8-second, are adjusted by changing the width of the corresponding slot in the slow speed setting cam. Widening the slot decreases the run-off time of the escapement (shortens the exposure), and narrowing the slot increases the exposure time. Check the shutter speed with the electronic shutter tester (par. *c* below) after each adjustment.

(3) *Cleaning and installing slow speed escapement.* Dry bearings, or foreign matter in the escapement, will adversely effect the slow speeds. If any components of the escapement are damaged, replace the entire assembly.

(a) Cleaning. Completely submerge the escapement in benzine and move it rapidly back-and-forth. Remove the assembly and dry it with compressed air. Oil the bearings, and again place it in benzine for a brief period. Take the escapement from the bath, and lightly blow out the benzine, leaving a thin film of oil on the bearings.

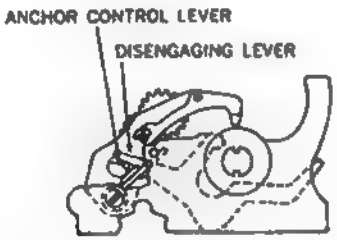

Figure 4–12. Position of Disengaging Lever.

(b) Installing. Install the slow speed escapement on the inner housing as described in paragraph 5–11. Take care that the disengaging lever (fig. 4–12) fits in front of the anchor control lever.

NOTE: The disengaging lever must deactivate the anchor at the 1/15-second setting

c. Checking Shutter Speeds Electronically. Shutter curtain curve patterns are checked on the shutter speed checking drum (par. *a* above). Shutter speeds are checked on the electronic shutter tester 42–253.01–Z1W111.

(1) Remove the hinged back from the camera, and install hinged back with mirror 42–253.01–Z1W41.

(2) Position the camera housing on the test instrument, fitting the lens mounting flange over the opening. Secure the camera to the instrument with the holding plate.

(3) Wind the camera shutter, set the speed dial to 1-second, depress the 1-second button on the test instrument, and release the shutter. The test instrument meter must register within the 1-second tolerance.

(4) Repeat the operation, as in (3) above, for each of the shutter speeds. The test instrument button, corresponding to the shutter speed being checked, must be depressed. The meter must register within the tolerance for that speed.

NOTE: Permissable shutter speed tolerances:

1/1000 through 1/250-second + or – 20%

1/125-second + or – 10%

1/60-second + 25% – 10%

1/30-second + 20% – 10%

1/15 through 1-second + or – 10%

4–9. Synchronizing Circuits

Before checking or adjusting the synchronizing circuits, shutter speeds should be checked (par. 4–8), and adjusted if necessary.

a. Checking and adjusting Flash Bulb Circuit (fig. 4–13). Set the voltage selector switch of test instrument 42–531–Z1W13 to 500-volts. Connect the camera flash lamp socket to the test instrument with connecting cord 42–253.04.

(1) *Checking insulation.*

NOTE: The camera shutter should be unwound before connecting to the test instrument.

Set the selector switch to "I". Hold the camera shutter release in the depressed position and turn the shutter speed dial through its range from 1/1000-second to "B". The meter should not register, and the indicator lamp should not light. If a current leakage is indicated, trace the circuit with test leads 103.25.18 and correct the fault.

(2) *Checking conductivity.* Set the selector switch to "D", wind the camera shutter and set the shutter speed dial to "B". Hold the first shutter curtain, depress the shutter release, and allow the curtain to move slowly across the film aperture. After approximately 5-millimeters of travel, the test instrument meter should indicate between 60 and 100. If it does not, check the circuit for poor connections, dirty contact points, or a defective flash lamp socket. Correct the fault.

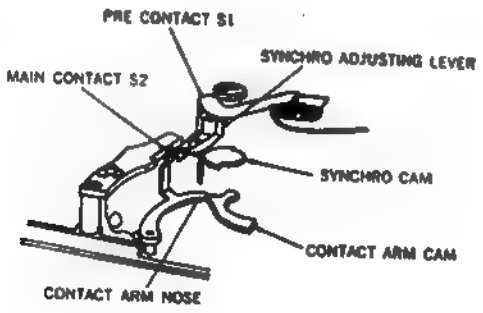

Figure 4–13. Flash Bulb Synchronizing Adjustments.

(3) *Checking contact closing* (fig. 4–13). Set the selector switch to "L", wind the camera shutter, and set the shutter speed dial to "B". Depress the shutter release. The indicator lamp must light. Repeat the operation for each of the shutter speeds, noting that the lamp lights each time the shutter is released. If it does not, check the contact points of switches S–1 and S–2, and correct the fault.

b. Checking and Adjusting Flash Bulb Synchronization (fig. 4–13, 4–14). Connect the camera's flash lamp socket to test instrument 42–253.01–Z1W109 with connecting cord 42–253.04. Remove the camera hinged back and insert tolerance pattern 42–253.01–Z1A96 in the film aperture. Position the camera lens mounting flange over the test instrument opening.

(1) Depress button (4) on the test instrument.

(2) Wind the shutter, and set the shutter speed dial to 1/1000-second.

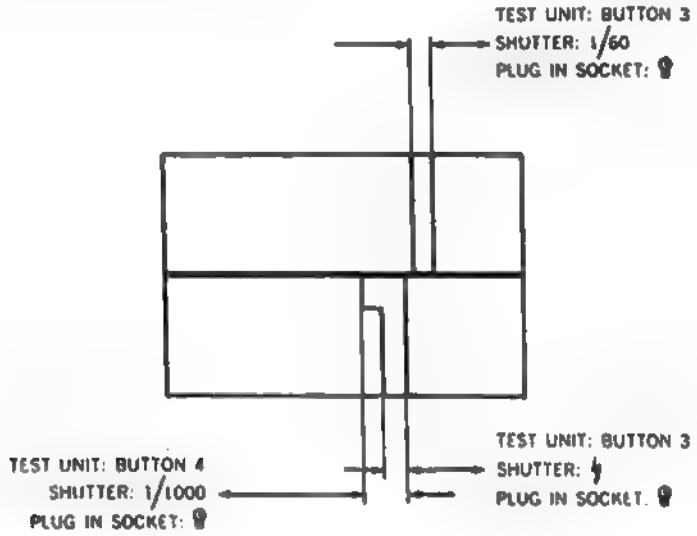

Figure 4–14. Flash Bulb Synchronizing Pattern.

(3) Release the shutter, and observe the position of the shutter slit on the pattern plate. The shutter opening should coincide with the wide pattern on the plate (fig. 4–14). If it does not, proceed as follows:

(a) Bend the main contact (S-2), fig. 4–13 with tool 42–253.01–U443W5.

(b) Repeat the test in (3) above, and readjust the main contact until the shutter slit coincides with the 1/1000-second pattern on the plate.

(4) Depress button (3) on the test instrument.

(5) Wind the shutter, and set the shutter speed dial to 1/60-second.

(6) Release the shutter, and observe the position of the first shutter curtain on the pattern plate. The edge of the shutter should fall within the narrow pattern on the upper part of the plate (fig. 4–14). If it does not, proceed as follows:

(a) Bend the contact arm nose (fig. 4–13) with tool 42–253.01–U443W6. Bending the nose toward the cam increases the delay of contact closing. Bending the nose away from the cam decreases the delay.

(7) After making a synchronizing adjustment, recheck and adjust alternately between 1/1000-second and 1/60-second until both settings are correct.

c. Checking and Adjusting Electronic Flash Circuit (fig. 4–15). Set the voltage selector switch of test instrument 42–531–Z1W13 to 1,000-volts. Connect the camera electronic flash socket to the test instrument with connecting cord 42–253.04.

(1) *Checking insulation.* Set the test instrument selector switch to "I".

(a) Wind the camera shutter and set the shutter speed dial to "B".

(b) Hold the first shutter curtain, preventing it from running off, and depress the shutter release. The meter should not register, and the indicator lamp should not light. Release the first curtain and let it run off.

(c) Wind the camera shutter half-way and depress the shutter release. The meter should not register and the indicator lamp should not light.

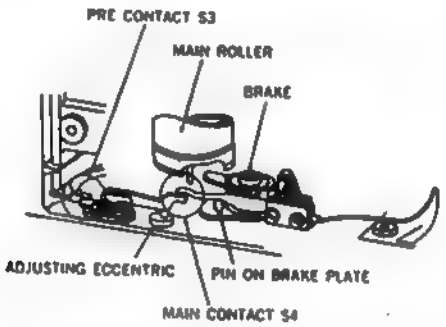

Figure 4–15. Electronic Flash Synchronizing Adjustments.

(d) If current leakage is indicated by tests (*b*) and (*c*) above, trace the circuit with test leads 103.25.18. Check for a short in pre-contact switch (S3). fig. 4–15, or a short in main contact switch (S4). Check for faulty insulation.

(2) *Checking conductivity.* Set the test instrument selector switch to "D".

(a) Wind the camera shutter and set the shutter speed dial to "B".

(b) Depress the shutter release. The test instrument meter should indicate between 80 and 100. If it does not, check the circuit for poor connections, dirty contact points, or a defective electronic flash socket. Correct the fault.

d. Checking and Adjusting Electronic Flash Synchronization (fig. 4–15, 4–16). Connect the camera electronic flash socket to test instrument 42–253.01–Z1W109 with connecting cord 42–253.04. Remove the camera hinged back and insert tolerance pattern plate 42–253.01–Z1A97 in the film aperture. Position the camera lens mounting flange over the test instrument opening.

(1) Depress button (6) on the test instrument.

(2) Wind the shutter, and set the shutter speed dial to the electronic flash symbol (1/50-second).

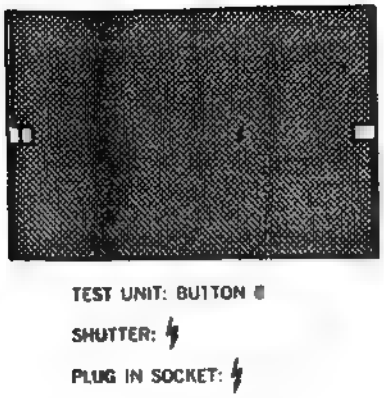

Figure 4–16. Electronic Flash Synchronizing Pattern.

(3) Release the shutter while observing the pattern plate. The two rectangles (one on each end of the pattern) must be illuminated. One-half millimeter of the outer edge of the left rectangle must be obscured by the first shutter curtain (fig. 4–16). The rectangle on the right end of the pattern must not be obscured in any degree by the second shutter curtain. If these conditions are not met, proceed as follows:

(a) Adjusting first shutter curtain pattern (fig. 4–15, 4–16). Position the adjusting eccentric (fig. 4–15) with tool 42–253.01–76W2 until 0.5mm of the first curtain shows in the left rectangle of the pattern plate (fig. 4–16).

(b) Adjusting second shutter curtain pattern. Recheck and adjust shutter speeds. Check and reposition the second shutter curtain, if necessary (par. 4–4).

4–10. Film Transport and Take-Up

(Fig. 4–17, 4–18, 35)

a. Film Transport. The inner housing must be removed from the outer housing in order to perform the following adjustments.

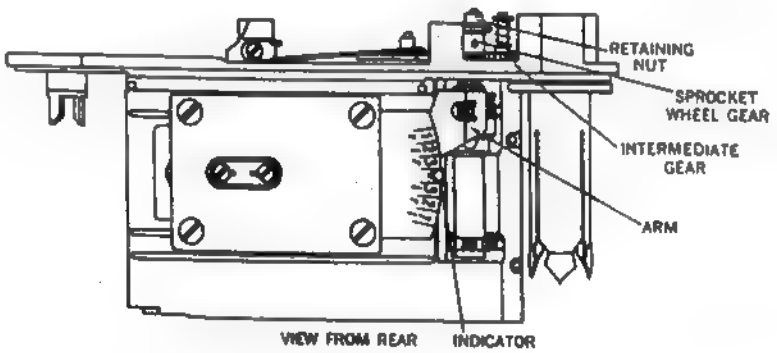

Figure 4–17. Sprocket Wheel Gauge in Test Position.

(1) Wind the camera shutter and position gauge 42–253.01–Z1A89 in the film aperture (fig. 4–17). A tooth of the sprocket wheel must appear through the opening in the gauge arm.

(2) Move the winding lever to the right as far as it will go, and hold it against its stop. The indicator gauge should rest at mid-scale. If the indicator is off-center, proceed as below.

(3) Remove intermediate double gear (25), figure 35; loosen retaining nut (29), and disengage intermediate gear (44).

(4) Turn the sprocket wheel one or more teeth, as indicated by the gauge.

NOTE: If the gauge indicator rests at 3, 2 or 1 "L", move the sprocket wheel that many teeth to the left. If the indicator rests in the "R" sector, move the sprocket wheel the indicated number of teeth to the right.

(5) Re-engage intermediate gear (44), and using the gauge, check that the indicator is centered. If it is not, repeat the procedure in (4) above until the gauge indicates the correct positioning of the sprocket wheel.

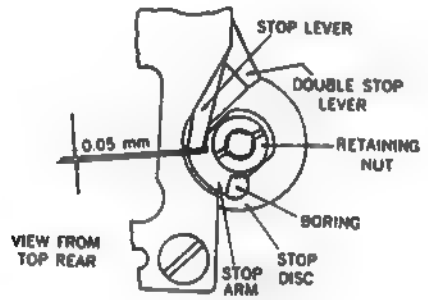

Figure 4–18. Position of Stop Disc.

(6) Position the stop disc and stop arm as illustrated in figure 4–18, and tighten the retaining nut. Sprocket wheel may have 0.1 to 0.2mm axial play.

(7) Reinstall intermediate double gear (25), fig. 35. Check for correct installation as follows:

(*a*) Wind the shutter, push the intermediate double gear to the right as far as it will go, and depress the shutter release button. The shutter should operate freely.

(*b*) Repeat the procedure in *(a)* above, but push the intermediate double gear to the left as far as it will go.

(8) Recheck the sprocket wheel position as in (1) and (2) above. The indicator should rest at the center of the gauge.

NOTE: When the film transport is properly adjusted, there should be approximately 0.05mm of play between the stop lever and stop disc, as illustrated in figure 4–18.

b. Film Take-Up (Fig. 35). The camera need not be disassembled to adjust the take-up spool compensating friction clutch. It is necessary to remove the top plate if gear (5) requires replacement.

(1) *Checking friction of compensating clutch.* Place 042.782.001–001–Z1W1 adapter on torsion gauge 42–253.01–Z1A59, and insert it in the take-up spool. Rotate the take-up spool by turning the handle of the gauge. The gauge index must position between the tolerance indicators. If it does not, adjust the friction of the compensating clutch as follows:

NOTE: The torque required to overcome friction of the clutch should be between 230 and 270 grams.

(2) *Reducing friction.* Remove spring (10) and decrease its pressure. Replace the spring and again check friction with the torsion gauge.

(3) *Increasing friction.* Place one or more additional washers (8) on holding shaft (13). Reassemble the clutch. Check friction with the torsion gauge.

4–11. Delayed Action Clockwork

(Fig. 4–19, 4–20, 28, 29)

a. Cleaning and Lubrication. Completely submerge the delayed action clockwork (10), fig. 28 in benzine and move it rapidly back-and-forth. Remove the clockwork from the bath and use compressed air to dry it. Oil all bearings and again submerge the clockwork in benzine for a brief period. Remove the clockwork from the bath and blow out the benzine, leaving a thin film of oil on the bearings.

b. Replacing Spring (fig. 29). Insert spring (1) in spring carrier (3) and wind it until it fits into the spring housing. Place the free end of the spring on stud (23).

c. Adjusting (fig. 4–19). After the delayed action clockwork has been installed, and the camera inner housing inserted in, and secured to the outer housing, wind the clockwork spring as follows:

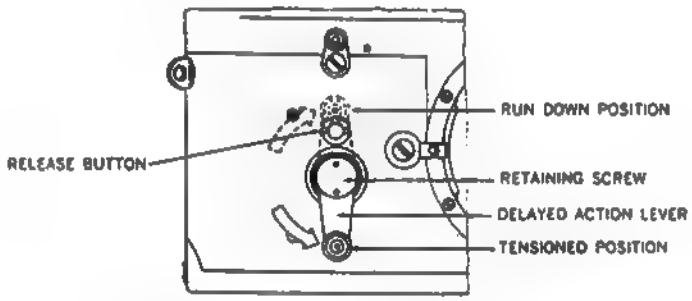

Figure 4–19. Delayed Action Lever, Tensioned Position.

(1) Tension the clockwork spring by turning the delayed action lever counterclockwise as far as it will go (fig. 4–19).

(2) Loosen the left-hand-threaded retaining screw with tool 42–253.01–597W2. Lift the lever, rotate it clockwise to the vertical position, and immediately tighten the retaining screw.

(3) Fully tension the clockwork spring by repeating the procedures in (1) and (2) above two or three times.

(4) Set the camera shutter speed dial to "B", wind the shutter, and depress the delayed action release button. The delayed action clockwork should not release the shutter. If the clockwork does trip the shutter, increase tension of the clockwork spring as in (1), (2) and (3) above.

(5) Hold the delayed action lever in its vertical (run-off) position and loosen the retaining screw, permitting the clockwork to operate.

(6) Tighten the retaining screw immediately after the second shutter curtain has been released

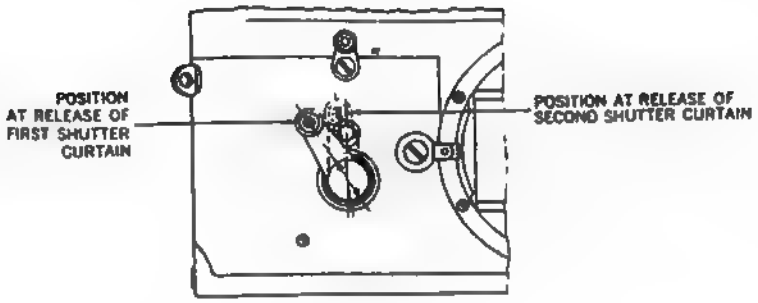

Figure 4–20. Delayed Action Lever, Releasing Positions.

d. Checking (fig. 4–20). Set the shutter speed dial to "B", wind the shutter, and depress the delayed action release button. The first shutter curtain should release when the delayed action lever is approximately 30° from its vertical position. The second curtain should release when the lever is approximately 5° from the vertical.

4–12. Lens Mounting Flange

(Fig. 4–21)

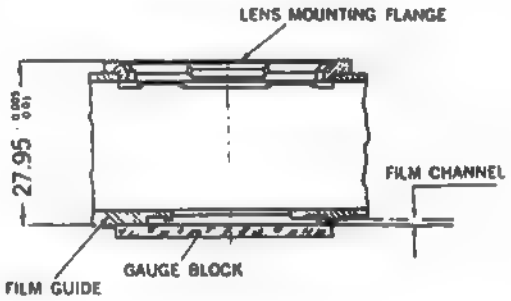

Figure 4–21. Film Plane Measuring Points.

a. Checking.

(1) Place the camera housing on the gauge block of gauge set 42–253.01–Z1A76 and rest the outer film guides on the mirror surface (fig. 4–21).

(2) Measure the distance from the lens flange to the gauge block with the dial gauge. The gauge indicator should read "zero". A tolerance of +0.005mm or −0.01mm is permissable.

NOTE: When the dial gauge is properly calibrated, a reading of "zero" is equivalent to 27.95mm.

(3) Place the auto-collimator on the lens flange and check parallity. The reticle reflection should coincide with the collimator's reticle. A deviation of one-half the thickness of a reticle line is permissable.

b. Repair.

(1) If the flange-to-gauge block distance is less than 27.94mm, replace the lens mounting flange.

(2) If the replaced lens flange, when secured to the housing, measures more than 27.955mm from the flange to gauge block, it must be turned down to the required thickness. Use lathe jig assembly 42–253.01–535W15.

(3) If the inner or outer camera housing, or lens mounting flange is bent, replace the damaged item.

4–13. Range-Viewfinder

(Fig. 27, 4–22 through 4–28)

a. Bright-line Frame Assembly. Replace if damaged

b. Range-viewfinder Assembly. Replace entire assembly if components, other than the bright-line frame assembly, are damaged.

c. Cleaning Bright-line Frame Glass Plate (fig. 27).

CAUTION: Do not remove glass plate (6) from glass plate mount (4).

Moisten a Q-tip with lens cleaner "U" and carefully wipe exposed surfaces on both sides of the glass plate. Use a clean dry Q-tip and remove the lens cleaner.

NOTE: Lens cleaner should not be allowed to dry on the surface and should be removed while still damp. If this procedure is not followed, dust particles will remain and be magnified in the viewfinder.

d. Adjusting Rangefinder.

NOTE: The lens mounting flange must be correctly adjusted (par. 4–12) before attempting to adjust the rangefinder.

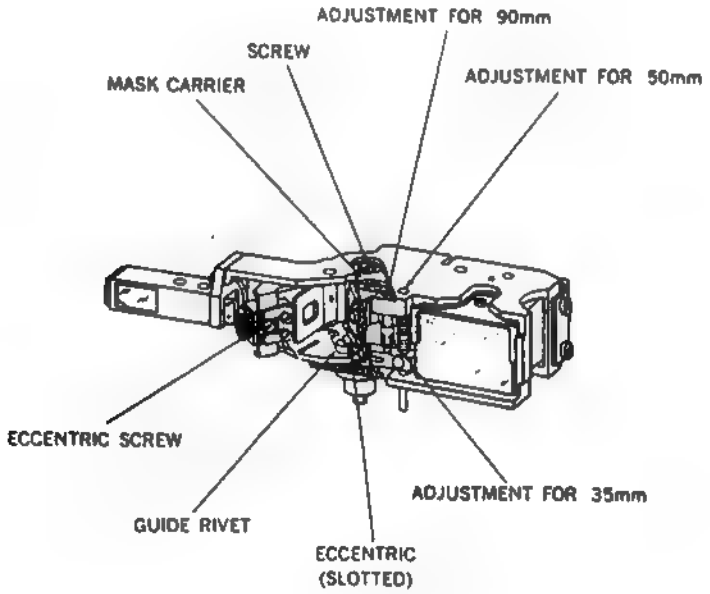

Figure 4–22. Range-Viewfinder Adjusting Points.

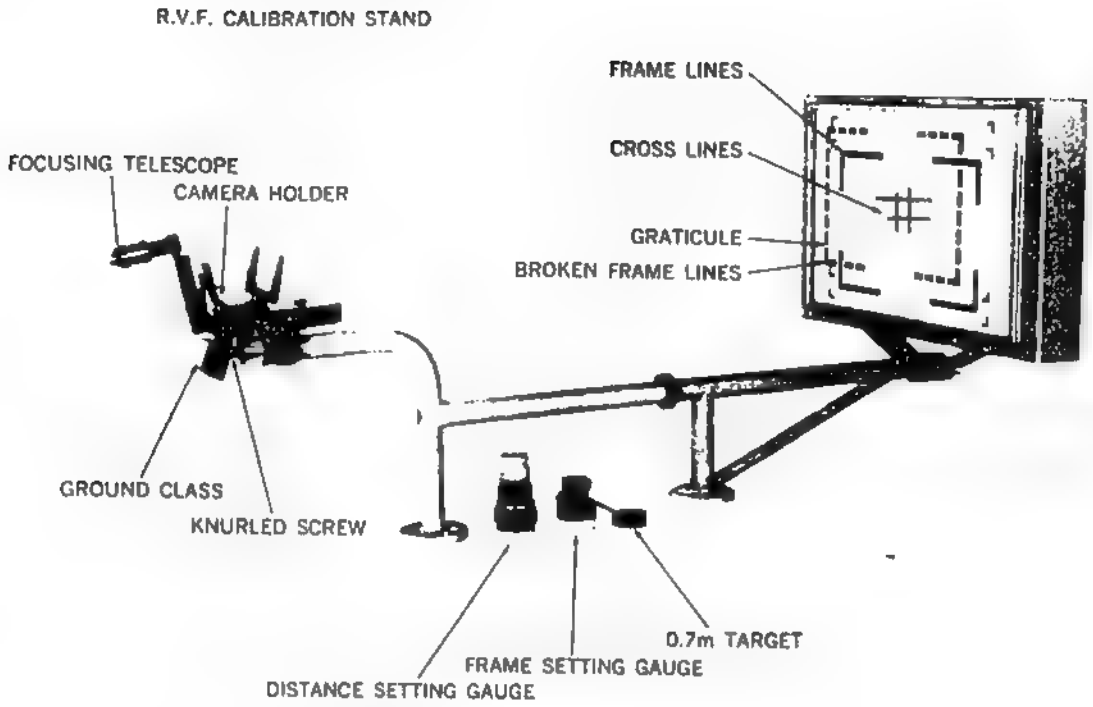

Figure 4–23. Range-Viewfinder Calibrating Stand.

(1) Mount the eyepiece lens 42–582.03–Z1W1 on the rangefinder (fig. 4–22) and secure the distance setting gauge 42–582.01–Z1A10 in the lens mounting flange. Place the camera in the holder of the calibrating stand (fig. 4–23) and adjust the focusing telescope to view the 10-meter graticule (fig. 4–24). Set the index of the distance setting gauge to infinity and view the graticule through the telescope.

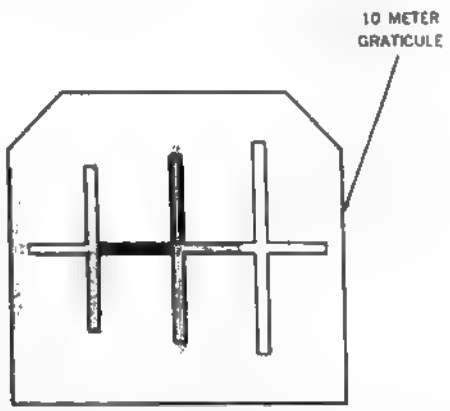

Figure 4–24. Rangefinder Image at Infinity.

(2) Turn the eccentric shaft (fig. 4–27) with tool 42–253.01–703W2 until the rangefinder image coincides laterally with the graticule (fig. 4–24). Adjust vertical image coincidence by turning the eccentric screw (fig. 4–22) with tool 42–582.03–Z1W6.

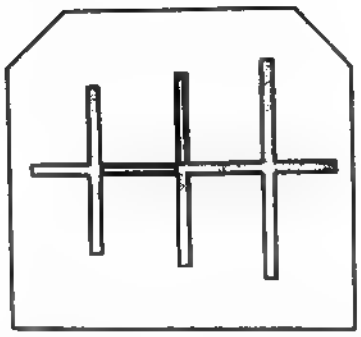

Figure 4–25. Rangefinder Image at 10-meters.

(3) Place the index of the distance setting gauge opposite the 10-meter mark and view the 10-meter graticule through the telescope. The rangefinder image should coincide with the graticule as illustrated in figure 4–25.

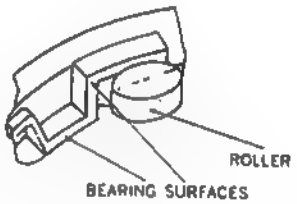

Figure 4–26. Distance Setting Bearing Surfaces.

(4) Rotate the distance setting gauge alternately clockwise and counterclockwise, from the 10-meter mark, to positions indicated by click stops. The rangefinder image should remain stationary, in relation to the graticule, during the back-and-forth rotation. If the rangefinder image moves, straighten the roller arm as in (5) below.

NOTE: The distance setting gauge has an upper and lower bearing surface, which rides on the rangefinder roller arm, between the limits of the 10-meter click stops (fig. 4–26). The off-set bearings permit checking the perpendicular alignment of the roller arm.

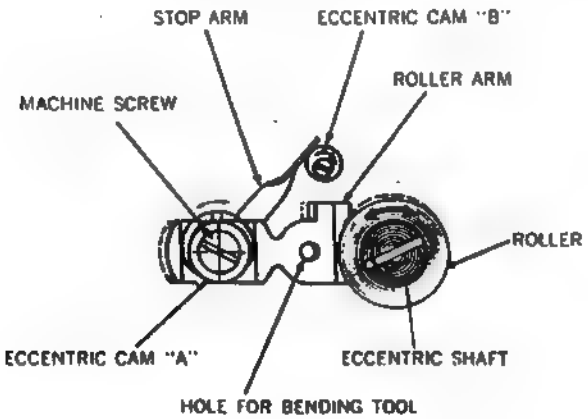

Figure 4–27. Range-Viewfinder Roller Arm.

(5) Insert bending tool 42–253.01–700W2 in the hole of the roller arm (fig. 4–27) and bend the roller arm until the images remain stationary. Follow the checking procedure in (4) above.

(6) Swing the viewing telescope away from the rangefinder eyepiece and adjust the camera holder of the calibrating stand to view the 1-meter cross-lines (fig. 4–23).

(7) Set the index of the distance setting gauge to 1-meter and view the cross-lines through the rangefinder eyepiece. The rangefinder image must coincide with the cross-lines. If the images do not coincide, proceed as in (8) below.

(8) Loosen the screw, holding eccentric cam "A" (fig. 4–27) with tool 42–253.01–630W6, and turn the cam until the images coincide. Tighten the screw.

(9) Alternately check, and adjust, between the 10-meter and 1-meter targets until the rangefinder image coincides with the target at each of the distances.

(10) Set the index of the distance setting gauge at 0.7-meters and check image coincidence on the 0.7-meter target. If the images do not coincide, alternately check, and adjust, at all distances as described in paragraphs (2) and (8) above. (Seldom is an adjustment necessary at 0.7-meters when adjustment is correct at other distances).

(11) After adjusting image coincidence (both laterally and vertically) at infinity, 10-meters, 1-meter and 0.7 meters, proceed as follows:

(a) Remove the distance setting gauge from the camera, and push the rangefinder roller arm to the rear. Adjust eccentric cam "B" so it stops the roller arm after a slight over-ride of the infinity setting. Secure the eccentric cam with a small quantity of cement "N".

(b) Bend the stop arm (fig. 4–27) to stop the roller arm in its forward movement after a slight over-ride of the 0.7-meter setting.

c. Checking and Adjusting Viewfinder Parallax (fig. 4–22, 4–28).

(1) Lock the distance setting gauge 42–582.01–Z1A10 in the lens mounting flange, and place the camera in the camera holder of the calibrating stand (fig. 4–23). Lock shutter release with tool 42–253.01–Z1W84. Position the groundglass screen behind the film aperture, and set the distance gauge for 1-meter. Adjust the camera holder to align the edges of the film aperture with the solid frame lines of the 1-meter graticule.

(2) View the 1-meter target through the camera viewfinder and 90mm bright-line frame which has been positioned by the setting gauge. The bright-line frame must coincide with the solid frame lines. If it does not, proceed as follows:

(a) Turn the slotted eccentric (fig. 4–22) until the viewfinder's bright-line frame is parallel with the solid frame lines of the graticule.

(b) Turn the guide rivet (fig. 4–22) with tool 42–582.03–62W2 until the bright-line frame coincides with the solid frame lines of the graticule.

(c) Set the distance setting gauge index to the infinity mark. The 90mm bright-line frame should move diagonally and coincide with the broken frame line (fig. 4–23) of the graticule. (Slight deviations in coincidence are permitted at the infinity setting).

(d) If the lines do not reasonably coincide at infinity, loosen the two screws (fig. 4–22) and shift the entire bright-line frame assembly. Recheck alternately between 1-meter and infinity. Readjust as necessary, with the guide rivet and by moving the mask assembly, until coincidence is obtained at both settings. Coincidence at 1-meter should be precise.

(e) Turn the distance setting gauge back-and-forth, between the 0.7-meter setting and infinity, while observing the bright-line frame through the viewfinder. Diagonal movement of the frame should be smooth and positive.

f. Checking and Adjusting Bright-Line Frame Masks.

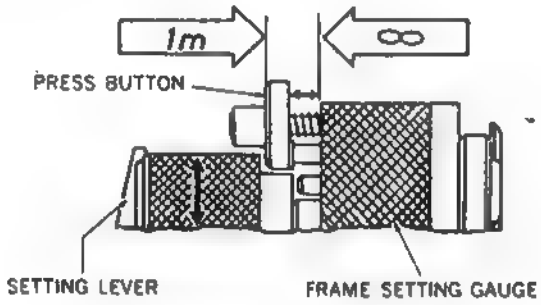

Figure 4–28. Frame Setting Gauge.

(1) Lock the frame setting gauge 42–253.01–Z1A107 (fig. 4–28) in the lens mounting flange, and place the setting lever of the gauge at mid-point to position the 50mm bright-line frame.

(2) Observe the 50mm bright-line frame in the viewfinder and rotate the large knurled portion of the frame setting gauge back-and-forth within its limits. Alternately depress and release the press button, while rotating the gauge. (Pushing the press button in positions the bright-line frame for infinity, and releasing it simulates the frame position at a distance of 1-meter). The 50mm bright-line frame should be fully visible without the 90mm or 35mm frames appearing in the field. If this condition is not met, proceed as follows:

(*a*) Turn the 50mm adjusting shaft (fig. 4–22) until only the 50mm bright-line frame is seen in its entirety.

(*b*) Repeat the checking procedures in (2) above.

(3) Release the setting lever and rotate the front portion of the frame setting gauge to position the 90mm bright-line frame.

(4) Observe the 90mm frame in the viewfinder and follow the procedures in (2) above. The 90mm bright-line frame should be fully visible without the 35mm or 50mm frame appearing in the field. If this condition is not met, proceed as follows:

(*a*) Turn the 90mm adjusting shaft (fig. 4–22), until only the 90mm bright-line frame is seen in its entirety.

(*b*) Repeat the checking procedures, but for the 90mm frame, as in (2) above.

(5) Rotate the front portion of the frame setting gauge to position the 35mm bright-line frame.

(6) Observe the 35mm frame in the viewfinder and follow the procedures in (2) above. The 35mm bright-line frame should be fully visible without the 50mm or 90mm frame appearing in the field. If this condition is not met, proceed as follows:

(*a*) Turn the 35mm multi-slotted adjusting nut (fig. 4–22) until only the 35mm bright-line frame is seen in its entirety.

(*b*) Repeat the checking procedures, but for the 35mm frame, as in (2) above.

(g) Final Range-Viewfinder Check. After installing the camera top plate, recheck, and if necessary adjust, the rangefinder as in paragraph *d* above. Recheck the viewfinder parallax and bright-line frames as in paragraphs *e* and *f* above.

NOTE: Eyepiece lens 42–582.03–Z1W1 must be removed from the rangefinder before installing the top plate.

4–14. Top Plate Assembly

(Fig. 21, 24)

a. Eyelens. Replace if damaged.

b. Range-Viewfinder Windows. Replace if damaged.

c. Illuminating Window. Replace if damaged.

NOTE: When installing the illuminating window, face the prismatic surface outward. To remove the holding bracket, open the metal clip slightly and slide the bracket down. When replacing, insert the bracket in the metal clip, slide it up, and close the clip.

d. Top Plate. If the top plate is badly dented, or otherwise damaged, replace it.

4–15. Hinged back

(Fig. 4–29))

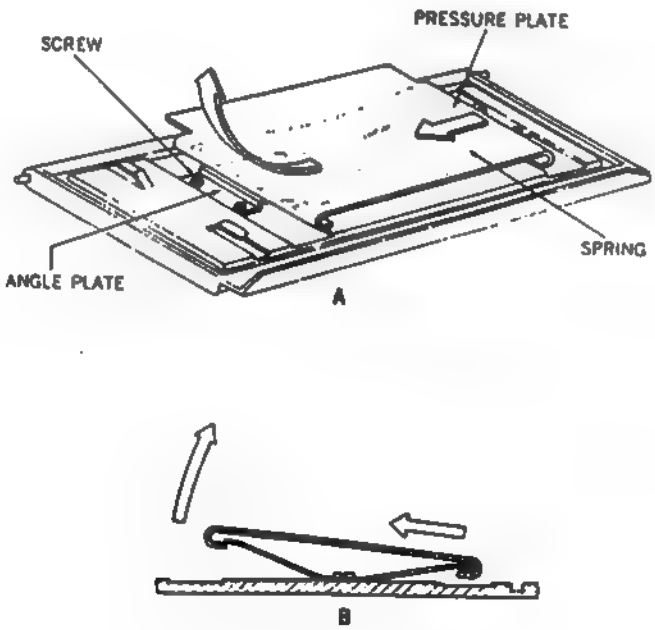

Figure 4–29. Pressure Plate Removal.

a. Repair of Pressure Plate. Replace if damaged.

NOTE: To remove the pressure plate, slide it lengthwise as indicated by the arrows in fig. 4–29 "A". Lift up the end (fig. 4–29 "B") until the spring is free. To install the pressure plate, hook one end in the spring, and lift the free ends of the spring with tweezers. Engage the other end of the pressure plate.

b. Checking Pressure Plate. Depress the pressure plate with the fingers, and check for adequate and even pressure.

4–16. Baseplate Assembly

(Fig. 22)

a. Film Positioning Disc. Replace if damaged.

b. Lock Assembly. Replace damaged parts.

c. Tripod Bushing. Replace baseplate.

d. Baseplate. Replace baseplate if it is badly dented, or bent out of shape.

Section II. EXPOSURE METER

4–17. General

In so far as possible, determine the repairs to be made before disassembling the exposure meter. Reference to chapter 2, section 2 (troubleshooting) will assist in isolating the component requiring repair or adjustment. Disassembly beyond that necessary should be avoided. In most instances, subassemblies become accessible by removing the housing (par. 3–10). Worn or damaged parts should be replaced before reassembling the exposure meter. Parts to be cleaned, lubricated or adjusted must be removed. Before testing the meter, set the indicator needle to mechanical zero, as described in TM 11–6720–244–12, paragraph 4–5*c*(5).

4–18. Battery Test Circuit

(Fig. 40)

Test the battery as described in TM 11–6720–244–12, paragraph 4–5*c* and figure 3–6. If the indicator needle does not rest on, or slightly beyond, the battery-test index, proceed as follows:

a. Replace the battery.

NOTE: Select a replacement battery that measures 1.35 volts.

b. If the indicator does not reach the index (with fresh battery installed) replace resistor (R1). (Value of the resistor should be 2,000-ohms).

c. If the indicator rests much beyond the index, replace resistor (R2). (Value of the resistor should be 100-ohms).

4–19. Coil assembly

(Fig. 40)

If the exposure meter readings are erratic, or if there is no indication, proceed as follows:

a. Desolder red lead from the coil assembly.

b. Check coil resistance and continuity with a multi-meter. Coil resistance should be approximately 1,500-ohms.

NOTE: Place the multi-meter probes on the coil assembly frame and coil point from which the lead was desoldered.

If the coil indicates an open circuit, or ground, replace the entire meter circuit insert (13).

c. Resolder red lead after checking coil.

4–20. Switches and Battery Contact

(Fig. 41)

If the coil assembly is not defective, proceed as follows:

a. Clean and adjust contact points of switch (1).

b. Clean and adjust contact points of switch arm (6).

c. Adjust battery housing spring tension.

4–21. Photo-Resistor (CdS cell)

Check the cell as follows:

a. Place a fresh battery, or one known to be of full voltage, in the exposure meter.

b. Completely cover the meter cell window with the finger, or other opaque material.

c. Actuate the exposure meter release button and note the deflection of the indicator needle. It should not move into the first black sector of the light-intensity scale.

NOTE: The meter indicator needle should be set to mechanical zero before making the test.

d. If the indicator needle deflects into, or past, the first black sector replace the entire meter circuit insert.

4–22. Checking and Calibration

CAUTION: The test instrument (42–655.01–Z1W7), calibration test instrument (42–655.01–Z1W22) and voltage regulator (KH10) should be turned on and twenty minutes allowed for stabilization.

a. Place the 1.33-volt battery substitute (part of calibration test instrument 42–655.01–Z1W22) in the meter battery housing.

b. Place the meter cell window tightly against the illuminating window of test instrument 42–655.01–Z1W7.

NOTE: All extraneous light should be excluded from the test instrument illuminating window and the meter cell window.

c. Set the meter's film speed index to ASA 25, the sensitivity switch to the black index, and the shutter speed scale to 1/8-second.

d. Set the left button of test instrument 42–655.01–Z1W7 to its low-light position. Depress button number 8.

e. Actuate the exposure meter release button. The indicator needle should align with f/5.6 on the black aperture scale. If it does not, proceed as follows:

(1) Remove housing (par. 3–10).

(2) Adjust potentiometer (P1), fig. 40.

(3) Replace housing, but do not secure. Note that indicator needle aligns with f/5.6 on the black aperture scale. If it does not, readjust potentiometer until it does.

f. Set the meter's film speed index to ASA 25, the sensitivity switch to the red index, and the shutter speed to 1/8-second.

g. Set test instrument 42–655.01–Z1W7 as described in paragraph *d* above, and position meter as described in *b* above.

h. Actuate the exposure meter release button. The indicator needle should align with f/5.6 on the red aperture scale. If it does not, adjust potentiometer (P2), fig. 40.

i. Repeat the test-adjusting procedures for low and high sensitivity meter settings until the readings are correct. If correct readings cannot be obtained by adjusting the potentiometers, replace the entire meter circuit insert (13), figure 40.

j. Check the exposure meter indicator needle readings through the entire range as follows:

(1) Place the meter cell window tightly against the illuminating window of test instrument 42–655.01–Z1W7 and actuate the exposure meter release button.

(2) Set the test instrument light level, and depress the numbered button as indicated in the table below. Set the exposure meter film speed index to ASA 25; set the meter sensitivity index, and shutter speed scale index to correspond with the test instrument settings indicated in the table. The meter indicator needle should point to f/5.6. A tolerance of 1/2-f/stop is permissible.

TEST INSTRUMENT		EXPOSURE METER	
Light level	Test button	Shutter speed	Sensitivity index
High	15	1/1,000	Black
	14	1/500	
	13	1/250	
	12	1/125	
	11	1/60	
	10	1/30	
	9	1/15	
Low	8	1/8	
	7	1/4	Red
	6	1/2	
	5	1-sec.	
	4	2-sec.	
	3	4-sec.	
	2	8-sec.	

(3) If the meter does not indicate correctly, replace the entire meter circuit insert.

Section III. LENSES

4–23. General

The replacement of optical components, or helical focusing mounts, is not authorized. Components are matched, and if damaged beyond repair, the entire lens must be returned to the manufacturer for replacement of parts and calibration.

4–24. Cleaning

CAUTION: Do not wipe or brush inside surfaces of lens elements. They are generally soft-coated and will be damaged. Remove foreign material from inner surfaces with a syringe or light force of compressed air.

The materials and methods for cleaning lenses are listed in TM 11–6720–244–12, paragraph 4–6. Fungus, which attacks some optical glasses in tropical environments, may be removed as follows:

a. Material

Hydrogen-peroxide, 3% solution

Ammonia, 28% solution

Alcohol, 180 proof

Distilled water

b. Removing Fungus.

(1) Just prior to use, mix 10–parts hydrogen peroxide with 3–parts ammonia solution.

(2) Moisten the lens surface with the solution and allow it to stand for several minutes.

(3) Wipe the lens surface with a clean piece of lens tissue.

(4) Thoroughly clean the lens surface with distilled water.

(5) If additional cleaning is required, wipe the surface with alcohol and dry with clean lens tissue.

NOTE: Fungus which has remained on an optical surface for a prolonged period etches the glass. In this instance, the entire lens must be returned to the manufacturer for replacement of the damaged element.

4–25. Lubrication and Gluing

The lubricants and adhesives used for repair of the KS–15(4) Camera Set lenses, and the methods of application, are listed in paragraph 4–3.

4–26. 35mm Lens

(Fig. 42)

a. Replace damaged fluted tube (3).

b. Replace damaged serial number ring (4).

NOTE: Ring must be sent to manufacturer for engraving serial number on replacement.

c. Replace damaged front ring (7).

d. Replace damaged diaphragm adjusting ring (11).

e. Replace damaged diaphragm blades.

f. Replace damaged focusing ring (20).

g. Replace damaged pressure spring (21) and sliding bar (22).

h. Replace damaged depth-of-field ring (24).

i. Replace complete helical focusing assembly (25) if any component is damaged.

j. Replace missing mounting indicator (26).

4–27. 50mm Lens Head and Focusing Scale Assembly

(Fig. 43)

a. Replace damaged index ring (5).

b. Replace damaged diaphragm adjusting ring (7).

c. Replace damaged diaphragm blades (12).

d. Replace damaged cover ring (15).

NOTE: Ring must be sent to manufacturer for engraving serial number on replacement.

e. Replace damaged sleeve (17).

f. Replace damaged spring ring (18).

g. Replace damaged focusing ring (19).

4–28. 50mm Helical Focusing Assembly

(Fig. 44)

If any components of the focusing assembly (6) (other than those below) are damaged, the entire assembly must be replaced.

a. Replace damaged or missing nipple (2).

b. Replace damaged stop spring (5).

c. Replace missing mounting indicator (7).

4–29. 50mm Viewing Unit

(Fig. 45)

a. Replace damaged finger grip (13).

b. Replace damaged stop (16).

4–30. 135mm Lens Head

(Fig. 46)

a. Replace damaged filter retaining ring (2).

b. Replace damaged retaining ring (3).

c. Replace damaged stop ring (4).

d. Replace damaged lens hood tubes and liners (5) through (8).

e. Replace damaged diaphragm adjusting ring (10).

f. Replace damaged diaphragm blades (20).

4–31. 135mm Focusing Mount

(Fig. 47)

If components of the differential cam assembly (8) or helical focusing assembly (14) are damaged, replace the entire assembly.

NOTE: Helical focusing assemblies are in different focal-length groups. When replacing an assembly, it must be matched with the focal length of the lens.

a. Replace damaged bayonet ring (3).

b. Replace damaged tripod bushing plate (5).

c. Replace damaged stop (11).

d. Replace damaged depth-of-field ring (13).

4–32. 135mm Viewing Unit

(Fig. 48)

If the main housing or optical components, except (15), are damaged, replace the entire viewing assembly.

a. Replace missing cover screws (1).

b. Replace missing screws (2) and (3).

c. Replace damaged cover plate (4).

d. Replace broken spring (8).

e. Replace damaged optical element (15).

f. Replace missing mounting indicator (20).

4–33. Collimating 135mm Viewing Unit

(Fig. 48)

The focusing mount and rangefinder coupling bar must be in proper adjustment before collimating the viewing unit.

a. Mount the lens on an adjustable support and attach ground glass housing 42–630.01–Z1A6NY with magnifier 16,486.

b. Mount target 42–630.01–Z1A7 on axis of lens at a distance of approximately 5-feet, and focu the lens.

c. Adjust the lens support to align the target. The lines on the target must parallel the edges of the camera film aperture.

d. Remove the ground glass housing and magnifier from the lens and attach a camera housing to the lens.

e. View the target through the camera viewfinder. If it is not parallel with the edges of the bright-line frame, proceed as follows:

(1) Snug in 3 adjusting screws C42–37.01–U60T1NY.

(2) Remove 2 cover screws (1).

(3) Loosen 6 screws (6).

(4) Turn the 3 adjusting screws, alternately, until the target is parallel with the bright-line frame.

(5) Tighten screws (6) and replace cover screws (1).

(6) Remove the 3 adjusting screws C42–37.01–U60T1NY.

f. Mount the camera and lens on a sturdy support and view an object at infinity. Set the lens focusing scale at infinity. The rangefinder images should coincide both vertically and horizontally. If they do not, proceed as follows:

(1) Loosen 4 screws (2) and 3 screws (3).

(2) Turn 2 adjusting screws (13), alternately, until the rangefinder images coincide vertically and horizontally.

(3) Tighten screws (2) and (3).

(4) Fill the adjusting holes with wax "M".

Section IV. FLASH UNIT

4–34. General

Repair of the flash unit, in most cases, is confined to the replacement of defective components. Mechanical damage is self-evident, and if the component can be straightened without effecting its operation, it need not be replaced.

4–35. Repair of Reflector

(Fig. 49)

a. Replace missing or damaged screws or ring nut.

b. Replace damaged reflector segments.

c. Replace damaged or bent segment cleats.

4–36. Repair of Bayonet-Base Lamp Adapter and Lamp Socket

(Fig. 50)

a. Bayonet-Base Lamp Adapter. Replace damaged components, or entire adapter assembly if badly damaged.

b. Medium Screw-Base Lamp Socket.

(1) Replace entire socket assembly if badly damaged.

(2) Replace weak or broken contact spring in contact spring assembly (10).

(3) Replace damaged insulator disc of contact spring assembly (10).

(4) Replace damaged lamp socket (12).

4–37. Repair of Battery-Capacitor Insert

(Fig. 51)

a. Replace entire insert if badly damaged.

b. Replace upper plate assembly (4) if plate or contact is damaged.

c. Replace damaged B-C housing (5).

d. Replace defective resistor (15).

e. Replace defective capacitor (18).

f. Replace damaged components of lower plate assembly (8), (9), (10), (11), (12) and (13).

4–38. Repair of Flash Unit Housing

(Fig. 52)

a. Straighten or replace damaged reflector mounting bracket (3).

b. Replace damaged pressure spring (4).

c. Replace damaged battery housing (6).

d. Replace defective rectifier (9).

e. Replace damaged contact spring (10) and contact clips (13) and (15).

f. Replace damaged mounting foot (18).

g. Replace damaged bottom block (19).

CHAPTER 5

REASSEMBLY

Section I. CAMERA BODY

5–1. General

Before reassembling the camera body, all components should be thoroughly inspected for damage or excessive wear. Parts should be cleaned and lubricated where required. Parts should not be forced and care should be taken not to misplace small washers, or other parts, while reassembling. Adjustments and alignments should be concurrent with assembly.

5–2. Reassembly of Shutter Curtain Assembly

(Fig. 38)

a. Insert spring roller shaft assembly (16) in ribbon spring roller (17) and secure by tightening with tool 42–253.01–246NY

NOTE: A small drop of Duco cement should be placed on the female threads of the spring roller.

b. Install washer (15) and 2 "C" clips (14) on spring roller assembly shaft (16).

c. Install washer (13) and tensioning stud (12), with left hand thread, on spring roller assembly shaft (16).

d. Insert spring roller shaft assembly (10) in spring roller (11) and secure by tightening with tool 42–253.01–246NY. (See note, par. *a*, above.)

e. Install 2 ribbon guide rollers (9), 2 washers (8) and 2 "C" clips (7) on spring roller assembly shaft (10).

f. Install tensioning stud (6), with left hand thread, on spring roller assembly shaft (10).

g. Reglue first shutter curtain (19) on first curtain spring roller (11).

h. Reglue first shutter ribbons (19) on main ribbon rollers.

i. Reglue second curtain ribbons (18) on ribbon spring roller (17).

j. Install second shutter curtain (18) on main roller (5) and secure with holding bar (2) and 2 screws (1).

5–3. Installation of Shutter Curtain Assembly

(Fig. 36)

a. Insert curtain assembly (9) in inner housing (21) and seat main shutter roller assembly shaft "C" in bearing (6).

b. Insert first and second curtain spring roller shafts "B" into its bearings.

c. Insert spring roller tensioning studs "A" in the borings for the adjusting bearings (4) and secure the bearings to inner housing (21) with tool 42–253.01–U257W3.

5–4. Reassembly and Installation of Brake Assembly

(Fig. 36, 37)

a. Install friction washer (17), fig. 37, lower actuating plate (16), brake disc (15), friction washe (14) and (13), upper actuating plate (12) and spring washer (11) on shaft "A" of bearing plate (19). Secure with screw (10).

b. Place brake shoe (3) with spring (2) on shaft "B" of bearing plate (19) and insert "C" clip (

c. Place spacer (9) on bushing (8) and secure in bearing plate (19) with tool 42–253.01–320W2.

d. Place washer (7) and spring washer (6) on shaft (5), insert assembly in bushing (8) and secur with eccentric nut (4) using tool 42–582.01–273W3.

e. Insert assembled brake assembly (3), fig. 36, into inner housing (21) and secure with screws (1) and (2).

5–5. Reassembly and Installation of Sprocket Wheel Assembly

(Fig. 35)

a. Place washer (36) on shaft (35).

b. Partially insert shaft (35) through the opening on the bottom of the inner housing and in its lower bearing. Place sprocket wheel (39) on shaft (35) from the rear of the inner housing, and push the shaft through its upper bearing (47).

c. Secure sprocket wheel with screw (34).

d. Place washer (48) and gear (33) on shaft (35) and secure gear with screw (32).

e. Place stop disc (31) and stop arm (30) on shaft (35). Secure with left hand threaded retainir nut (29) using tool 42–253.01–31W3.

f. Place curved bracket (38) around sprocket wheel (39) and secure to inner housing with 2 screws (37).

5–6. Reassembly of Intermediate Gear Assembly

(Fig. 35)

Place intermediate gear (44), locking lever (43), spring (42) and washer (41) on shaft (46). Inse "C" clip (40).

5–7. Reassembly and Installation of Take-Up Spool Assembly

(Fig. 35)

a. Place washer (6) on shaft of gear (5).

b. Insert gear (5) through bearing (17), place washer (4) on shaft of gear (5) and insert "C" clip (3).

c. Fit release disc (14) into gear (5) and secure with holding shaft (13) using tools 42–782.001–161WNY and 42–782.001–162W1.

d. Place bushing (11) inside take-up spool (12) and on holding shaft (13).

e. Place washer (8) inside bushing (11) and place bushing (11) on holding shaft (13).

f. Place spring (10) in bushing (11) and on holding shaft (13). Secure with screw (7).

g. Place spring (9) inside take-up spool (12) with tool 042–782.001–001ZW2.

5–8. Installation of Shutter Release Components

(Fig. 31, 35, 36).

a. Place flat spring (20), fig. 35, on bottom side of inner housing. Secure with short screw (19) and long screw (18).

NOTE: Long screw (18) is placed at front of inner housing.

b. Partially insert intermediate gear shaft (24) into its boring and place arresting lever "A" (27) with spring (28) on shaft.

c. Place washer (26) and intermediate gear (25) on intermediate gear shaft (24) and push shaft in all the way. Secure with ▮ screws (23).

d. Rest long free end of spring (28) against insulating cap (13), fig. 36, of adjusting eccentric (12)

e. Insert release rod (2), fig. 35, in its borings and rest lower end on flat spring (20).

f. Insert release shaft (1) through its boring and place slotted end of release shaft on shoulder of release rod (2).

g. Insert arresting lever "B" (34), fig. 31, in inner housing and rest lower end on adjusting screw (22), fig. 35, of flat spring (20).

h. Install spring (33), fig. 31, and secure with holding plate (32) and screw (31).

5–9. Installation of Components Disjoined from Shutter Bearing Plate Assembly

(Fig. 31)

a. Place washer (21) and spacer sleeve (22) on lower shaft of adjusting lever assembly (20).

b. Place washer (17) on upper shaft of adjusting lever assembly.

NOTE: Washer is placed on top of "C" clip (18).

c. Place adjusting lever assembly in countersunk boring.

d. Place shaft (45) with spring (44) on double stop lever (43) in its boring.

e. Place stop lever (26), washer (25), spacer ring (24) and spring (23) on shaft (45).

5–10. Installation of Shutter Bearing Plate Assembly

(Fig. 31)

a. Align all mating parts with shutter bearing plate assembly (8) and place bearing plate in position. Secure with 2 screws (13).

b. Insert sleeve (12) between bearing plate and inner housing. Rest free ends of springs (23) and (44) against opposite sides of sleeve (12).

c. Insert long screw (11) through bearing plate (8) and sleeve (12). Tighten screw.

d. Lift shaft (45) and insert "C" clip (10).

e. Solder ground wire (9) to bearing plate (8).

5–11. Installation of Slow Speed Escapement

(Fig. 31)

a. Place slow speed escapement (16) in position on top of inner housing.

b. Partially insert threaded shaft (14) in bearing plate (8) and place spring (15) on shaft. Secure threaded shaft in bearing plate. Allow 0.1 mm of axial play for the escapement.

c. Place free ends of spring (15) in position. (On bearing plate and rivet of escapement).

5–12. Reassembly and Installation of Drive Shaft Assembly

(Fig. 31, 34)

a. Place ratchet gear (15), fig. 34, on drive shaft bearing and insert drive shaft (14) in bearing.

b. Place washer (13), carrier disc (12), spring (11), carrier sleeve (10), spring (9), washer (8), ratchet plate (7), drive shaft gear (6), and washer (5) on drive shaft (14). Secure with "C" clip (4). Position spring (11) in boring of sleeve (10) and on bar of bearing plate.

c. Place spring (1) on screw (3) and fasten screw in bearing plate (16).

d. Insert pawl (2) and position spring (1).

e. Install drive shaft assembly (41), fig. 31, on inner housing; at the same time aligning pawl with eccentric of take-up spool assembly gear.

f. Secure drive shaft assembly to inner housing with 3 screws (42).

5–13. Reassembly and Installation of Rewind Assembly

(Fig. 31)

a. Insert rewind fork (7) in inner housing and secure to gear (6) using tools 42–253.01–79W4 and 42–253.01–80W8.

b. Place washer (4) on rewind shaft (5) and insert in bearing assembly (3).

c. Place assembly (3) on inner housing and place sleeve (2) over assembly (3). Secure with 2 screws (1).

5–14. Reassembly and Installation of Synchronizing Circuit Components

(Fig. 30)

a. Electronic Flash Circuit (Fig. 30).

(1) Place long contact spring (3) and insulating plates (4) and (2) on brake bearing assembly. Secure with 2 screws (1).

(2) Position lower insulating plate (10), short contact spring (9), insulating shield (8), upper insulating plate (7) and metal plate (6) in inner housing. Secure with 2 screws (5).

(3) Position metal tube (15) with wires (11) and (16) in its borings.

(4) Install guide spring (14). Secure with screw (13) and nut (12) using tool 42–253.01–338W2

(5) Solder wire (16) to long contact spring (3) and terminal (25).

(6) Solder wire (11) to guide spring (14) and grounding plate (24).

(7) Place grounding plate (24) and terminal frame (18) on shutter bearing assembly plate. Secure with screw (17).

b. Flash Bulb Circuit (fig. 30).

(1) Place spring (27) and synchro adjusting lever (28) on shoulder of screw (26). Place short end of spring in synchro adjusting lever and mount on bearing plate. Tighten screw (26). Place free end of spring in slot on bearing plate.

(2) Place insulating plate (23), contact spring (21) and insulating plate (20) on inner housing. Secure with 2 screws (19).

(3) Solder wire (22) to contact spring (21) and terminal (29).

(4) Place grounding plate (24) and terminal frame (18) on shutter assembly bearing plate. Secure with screw (17).

NOTE: This paragraph does not apply if the disassembly procedure described in paragraph *a*(7) above was carried out.

5–15. Reassembly and Installation of Delayed Action Release Clockwork

(Fig. 28, 29)

a. Install spring (1) on spring carrier (3) and stud (23), fig. 29.

b. Place clockwork mechanism (10) in inner housing and secure with 2 screws (9), fig. 28.

5–16. Installation of Main Light Shield

(Fig. 28)

Place main light shield (8) in inner housing and secure with screw (6) and screw (7).

5–17. Installing Lens Mounting Flange on Outer Housing

(Fig. 39)

a. Place spring ring (25) inside housing and secure with 4 screws (24).

b. Place lens mounting flange (23) on housing and secure with 4 screws (22).

c. Place lens lock (16) on housing and secure with screw (15).

5–18. Installing Inner Housing in Outer Housing

(Fig. 28)

a. Fully tension spring of delayed action release clockwork (10).

b. Place inner housing (14) in outer housing (11).

CAUTION: So not unhook the spring from the frame selector sliding bars which is located on the inside front of the outer housing. Make certain the frame selector sliding bars pass through the milled opening on the lower edge of the inner housing. Do not use force.

NOTE: Move the delayed action release lever through a small arc to engage its coupling ke with winding disc of the clockwork.

c. Secure inner housing to outer housing with screw (5) and 4 screws (4).

d. Position frame selector lever (13) and tighten screw (12) with tool 42–253.01–667W5.

e. Place reverse lever (3) on camshaft and secure with screw (2).

5–19. Reassembly and Installation of Range-Viewfinder Assembly

(Fig. 25, 26, 27)

a. Reassembly (fig. 25, 26, 27).

(1) Place metal mask (7) and glass plate mount (4) with glass plate (6) on mask carrier (8) fig. 27.

(2) Replace screw (2) with spring (3) and position free end of spring.

(3) Replace spring (1) and position.

(4) Place bright-line frame assembly in housing of range-viewfinder and secure with 2 screws (1), fig. 26.

(5) Place light shield (18) on right of range-viewfinder housing and secure with Duco cement (fig. 25).

(6) Place light shield (19) on rangefinder roof prism housing and secure with Duco cement (fig. 25).

b. Installation (fig. 25).

(1) Position plastic washer (16) and plastic plate (17) on top of inner housing.

(2) Position range-viewfinder assembly on inner housing and secure with 2 screws (2).

(3) Install screw (14) with eccentric nut (15) using tool 42–253.01–114W1.

(4) Place stop arm (13), roller arm (11) with cam (12), and washer (10) on roller arm axle. Secure with screw (9) using tool 42–253.01–630W6.

(5) Install cover plate (8) in light shield with tool 42–253.01–804W2.

(6) Position spacer (7), locking bar (6) and cover plate (5) on bottom of inner housing. Secure with 2 screws (3) and screw (4).

NOTE: Spacer (7) is not required on all cameras.

5–20. Reassembly and Installation of Top Plate

(Fig. 21, 24)

a. Reassembly (fig. 24).

(1) Install eyelens (6) with tool 42–253.01–86W4.

(2) Position window (4), illuminating window (3), and window (2). Secure with adhesive.

(3) Install holding bracket (5).

(4) Install and tighten screw (1).

b. Installation of Top Plate (fig. 21).

(1) Position release sleeve (32) with release knob (31) and place saddle spring (30) on ratchet wheel.

(2) Place top plate (5) on top of camera body.

(3) Install 2 locking springs (28) in bushings (27).

(4) Install 2 flash socket bushings (27) with tool 42–253.01–483W8.

(5) Install 2 flash socket cover rings (26) with tool 42–253.01–486W1.

(6) Install retaining ring (25) with tool 42–253.01–498W2.

(7) Install slotted sleeve (23), carrier (24), rewind knob (22) and washer (21). Secure with screw (20) using tool 42–253.01–494W4.

(8) Position spring (19), pressure plate (18) and accessory clip (17). Secure with 4 screws (1

(9) Install screw (16) in accessory clip (17).

(10) Position speed dial (14) and secure with screw (13).

(11) Install screw (12) with tool 42–582.01–27W1.

(12) Position felt ring (11) and secure with adhesive.

(13) Engage counting dial (10) with ratchet wheel.

(14) Position spacer (9), winding lever (8), and saddle spring (7). Secure with screw ring (6) using tool 42–253.01–36W4.

(15) Install and tighten screw (29).

5–21. Reassembly and Installation of Hinged Back

(Fig. 23)

a. Engage pressure plate (3) with spring (4) on hinged back (6).

b. Engage 2 angle plates (2) with spring (4) and secure with 4 screws (1).

c. Install spring (9) and locking pin (8). Push in locking pin and secure with actuator (7) using tool 42–253.01–571W1.

d. Push actuator to the side and install hinged back on outer housing.

5–22. Reassembly of Baseplate

(Fig. 22)

a. Place handle (12) on lock stud (11) and secure with pin (13).

b. Place washer (10) on lock stud assembly (11, 12, 13) and insert in baseplate.

c. Place washers (8), (7) and (6), and locking plate (5) on lock stud.

d. Place washer (4) on lock stud and secure assembly with screw (3).

e. Place film positioning disc (2) on shaft and secure with screw (1).

Section II. EXPOSURE METER

5–23. General

Before reassembling the exposure meter, clean all switch contacts and inspect components for damage. Parts should fit snugly without forcing.

5–24. Switches and Gear System

(Fig. 41)

a. Position coupling knob (21), with spring, in boring of meter circuit insert (2).

b. Install battery cover and mounting foot (see TM 11–6720–244–12, figure 5–2.)

c. Insert spring (20) in boring of mounting plate (19), and align spring loop with screw hole.

d. Insert shaft of sector gear (18) in center boring of mounting plate (19).

e. Place washer (17) on shaft of sector gear (18), and secure to mounting plate (19) with "C" clip (16).

f. Position sector gear assembly (15) on meter circuit insert (2), and secure with 2 screws (14).

g. Place nose washer (13), and washer (12) on shaft of coupling knob (21).

h. Place gear (11) on shaft of coupling knob (21).

NOTE: Index of coupling knob must align with meter housing index when housing is installed.

i. Place washer (10) on gear (11) and secure with screw (9).

j. Insert battery test switch (1) in slot of meter circuit insert (2), and hook free end of spring (20) to test switch.

k. Place insulating washer (8), and washer (7), on meter circuit insert (2).

l. Install switch arm (6), spacer (5), and washer (4). Secure with screw (3).

5–25. Installing Housing

(Fig. 40, 41)

a. Mount housing (10), figure 40, on meter circuit insert (13). Align coupling knob index with meter housing index.

b. Position speed dial (6) so as to align "B" (2-second setting) with the shutter speed index.

c. Mount the exposure meter in the camera accessory clip of the camera, and rotate the coupling knob so as to position the camera shutter speed dial at the electronic flash symbol (1/50-second). The red dot of speed dial (6) must align with the shutter speed index. If it does not, proceed as follows:

(1) Remove housing (10) and disengage gear (11), fig. 41. Rotate the gear 1/4-turn and re-engage.

(2) Replace housing (10), fig. 40. The red dot of speed dial (6) should align with the shutter speed index as in *c* above. If it does not, repeat the procedure in (2) above until it does.

d. Remove housing (10), tighten 2 screws (14), fig. 41, and replace housing on meter circuit insert.

e. Check that sensitivity switch (14), fig. 40, is engaged with sensitivity switch linkage (22), fig. 41.

f. Secure housing (10), fig. 40, to meter circuit insert (13), with 2 screws (9) and 2 screws (8).

g. Place washer (11), fig. 40, on shaft of coupling knob (21), fig. 41.

h. Place speed dial (6), fig. 40, spacer washer (4), spacer washer (5), and aperture dial (3) on shaft of the sector gear.

NOTE: Spacer washers (4) and (5) normally remain attached to aperture dial (3).

Position aperture dial so as to fit its rivet into the guide slot of the speed dial.

i. Secure the aperture dial with screw (1) using tool 3,719.004.01/5W1NY.

j. Mount the exposure meter on the camera and align with the camera top plate as described in TM 11–6720–244–12, paragraph 5–3*b*.

Section III. LENSES

5–26. General

Before reassembling a lens, all components should be inspected for damage, cleaned, and lubricated where required. Parts should not be forced, and scribed mating marks should match. Lenses should be checked photographically after reassembly.

5–27 Reassembly of 35mm Lens

(Fig. 42)

a. Replace depth-of-field ring (24) and 3 screws (23).

b. Replace focusing ring (20) with pressure spring (21) and sliding bar (22). Screw in retaining ring (19) and dowel screw (18).

c. Reassembly of Diaphragm.

(1) Install 10 diaphragm blades and diaphragm guide ring in lens tube (17).

(2) Mount rear optical components in lens tube (17).

(3) Slide front optical components into lens tube (17) and secure with retaining ring using tool 42-672.01-3-1W1NY.

d. Replace inner ring (16), 2 guide screws (12), circular clip (13), ball (15) and spring (14).

e. Slide on diaphragm adjusting ring (11). Secure with retaining ring (10) and set screw (9).

f. Replace front ring (7) and 3 screws (6).

g. Replace serial number ring (4) and secure with fluted tube (3).

h. Slide on adjustment ring (8) and screw in retaining ring (5).

5-28. Reassembly of 50mm Viewing Unit

(Fig. 45)

NOTE: Bonding of most components prevented complete disassembly of the viewing unit. Reassembly is limited to parts previously disassembled.

a. Replace stop (16) and screw (15).

b. Replace finger grip (13) and 2 screws (12).

5-29. Reassembly of 50mm Helical Focusing Assembly

(Fig. 44)

NOTE: Due to the necessity of matching the focusing assembly to the focal length of the lens, it was not completely disassembled.

Replace nipple (2), stop spring (5), segment (4) and 2 screws (3).

5-30. Reassembly of 50mm Lens Head and Focusing Scale Assembly

(Fig. 43)

a. Attach segment (23) to stop ring (25) with 3 screws (22).

b. Attach stop (21) to focusing ring (19) with screw (20).

c. Slide focusing ring (19) over stop ring (25).

d. Screw sleeve (17) with spring (18) into stop ring (25).

e. Attach assembled components (of *d* above) to the helical focusing assembly (fig. 44) with retaining ring (16).

f. Slide on cover ring (15).

g. Reassembly of Diaphragm.

(1) Position 10 diaphragm blades (12) in lens tube (14).

(2) Position diaphragm guide ring (11) in lens tube (14).

h. Slide on inner ring (13) and replace 2 guide screws (10).

i. Position ball (9) and flat spring (8) in slot of inner ring (13).

j. Slide on diaphragm adjusting ring (7) and replace 2 set screws (6) and 1 dowel screw.

k. Slide index ring (5) onto lens mount (3) and replace set screw (4).

l. Screw lens mount (3) into lens tube (14).

5–31. Reassembly of 135mm Viewing Unit

(Fig. 48)

a. Replace optical element (15) and flat spring (14). Tighten 2 adjusting screws (13).

b. Replace pressure spring (8), retaining plate (7) and 1 screw (6).

c. Attach cover plate (4) with 4 screws (2) and 3 screws (3).

d. Replace 2 cover screws (1).

5–32. Reassembly of 135mm Focusing Mount

(Fig. 47)

a. Attach bayonet ring (3) and viewing unit assembly (7) to differential cam assembly (8) with 6 screws (2).

b. Mount depth-of-field ring K(13) on helical focusing assembly (14). Secure with retaining ring (12) using tool 42–37.01–U60W3NY.

c. Attach stop (11) with screw (9) and nut (10).

d. Slide helical focusing assembly (14) over differential cam assembly (8). Secure with coupling ring using tool C42–37.01–U60T6.

e. Replace screw (6), tripod bushing plate (5) and 2 screws (4).

5–33. Reassembly of 135mm Lens Head

(Fig. 46)

a. Assembly of Diaphragm.

(1) Position 12 Diaphragm blades (20) in lens tube (21).

(2) Place diaphragm guide ring (19) in lens tube (21) and secure with circle clip (18). Replace guide screw (17).

b. Screw lens mount (14) into lens tube (21) and replace set screw (13).

c. Slide inner ring (16) on lens tube (21) and secure with circle clip (15). Replace ball (11) and flat spring (12).

d. Slide diaphragm adjusting ring (10) onto lens tube (21). Secure with 3 set screws (9).

e. Replace lens hood liners (6) and (8) in lens hood tubes (5) and (7).

f. Slide outer lens hood tube (7) over inner lens hood tube (5). Secure with stop ring (4).

g. Slide assembled lens hood over lens mount (14) and secure with retaining ring (3).

h. Replace filter retaining ring (2).

Section IV. FLASH UNIT

5–34. Reassembly of Reflector

(Fig. 49)

a. Insert segment cleat (5) into slot of lower reflector segment (8) and into slot of adjacent reflector segment (7). Continue in this manner until all segments, except (6), have been hooked to each other.

b. Place upper reflector segment (6) on top of previously hooked segments and insert the free end of the last segment cleat.

c. Mount the assembled reflector segments on shoulder screw (1) and secure to reflector handle with ring nut (2) using tool 42–471-117W3NY.

d. Secure lower reflector segment (8) to reflector handle (4) with screw (3).

5–35. Reassembly of Bayonet-Base Lamp Adapter

(Fig. 50)

a. Position intermediate sleeve (6) on socket inner sleeve (9) and align the slots.

b. Install release spring (5) on intermediate sleeve (6), and slide socket shell (3) on assembly just far enough to hold release spring (5) in position.

c. Install ejector button (4) in socket shell (3) and push the shell against the shoulder of inner sleeve (9).

d. Align the mounting holes and secure with three screws (2).

5–36. Reassembly of Medium-Base Lamp Socket

(Fig. 50)

a. Insert contact spring through hole in the insulator disc of contact spring assembly (10).

b. Install the upper contact cap, of contact spring assembly (10), on the contact spring using tool 42–471–U48W1NY.

c. Press contact spring assembly (10), and retaining ring (11) into lamp socket (12) with tool 42–471–U39W2NY.

5–37. Reassembly of Battery-Capacitor Insert

(Fig. 51)

a. Install contact spring (11) on lower inside plate (10).

b. Install soldering lug (13) with screw (8).

c. Assemble lower plates (10) and (12) with 4 assembly rods (7) and screws (6).

d. Solder one end of resistor (15) to soldering lug (13), and the other end to contact spring (11).

e. Solder negative lead of capacitor (18) to lug (13).

f. Slide the lower plate assembly, with attached components, into B–C housing (5).

g. Solder positive lead of capacitor (18) to soldering lug (16) of upper plate assembly (4).

h. Mount upper plate assembly (4) on assembly rods (7) with 4 screws (1).

i. Replace round nuts (3) and (9) using tool 42–471–296W4NY.

5–38. Reassembly of Flash Unit Housing

(Fig. 52)

a. Secure mounting foot (18) to bottom block (19) with 3 screws (17).

b. Install narrow contact clip (15) in bottom block (19).

c. Install wide contact clip (13) with contact strip (14) in bottom block (19).

d. Position insulating strip (12) over contact clips (13) and (15), and secure with screw (11).

e. Install contact spring (10), with contact wire (16), and solder wire to narrow contact clip (15).

f. Install rectifier (9), contact plate (8), and secure with screw (7).

g. Install bottom block (19) in battery housing (6), and secure with 3 screws (5).

h. Insert screw (1) in upper hole of reflector mounting bracket (3), and place pressure spring (4) (closed side up) over screw.

i. Position retaining plate (2) inside housing (6) with flat side next to housing wall. Mount bracket (3), pressure spring (4) and plate (2) to housing with 1 screw (1). Position the assembly to align the lower mounting holes, and secure to housing (6) with the second screw (1).

APPENDIX A

TOOLS AND TEST EQUIPMENT

TOOL NUMBER	WHERE USED
	Camera
1. 42–253.01–571W1	Hinged back
2. 42–253.01–36W4	Screw ring and eye lens
3. 42–582.01–27W1	Top plate (unslotted screw)
4. 42–253.01–494W4	Rewind screw
5. 42–253.01–80W8	Rewind fork
6. 42–253.01–498W2	Top plate, retaining ring
7. 42–253.01–486W1	Synchro cover rings
8. 42–253.01–483W8	Synchro bushings
9. 42–253.01–804W2	Cover light shield
10. 42–253.01–114W1	Rangefinder (center screw)
11. 42–253.01–637W5	Frame selector screw
12. 42–253.01–338W2	Nut, holding guide spring
13. 42–253.01–79W4	Rewind gear (and tool #5)
14. 042–782.001–001ZW2	Take-up spool spring
15. 42–782.001–162W1	Take-up holding shaft
16. 42–782.001–161WNY	Release disc
17. 42–253.01–31W3	Sprocket wheel shaft retaining nut
18. 42–582.01–273W3	Brake eccentric nut
19. 42–253.01–320W2	Bushing (brake)
20. 42–253.01–U257W3	Tension bearing
21. 42–253.01–246NY	Tension spring rollers
22. 42–253.01–Z1A92	Depth gauge for second curtain
23. 42–253.01–Z1L74	Release gauge
24. 42–253.01–Z1A22	Weight gauge (flat spring)
25. 42–216–Z1W42	Spring tension gauge (tension rollers)
26. 42–253.01–Z1A95	Speed pattern
27. 42–253.01–Z1W100	Drum (shutter testing)
28. 42–253.01–U281W3	Key for arresting lever "B" eccentric
29. 42–253.01–Z1W111	Electronic shutter tester

TOOL NUMBER	WHERE USED
30. 42-253.01-Z1W41	Back door with mirror
31. 42-253.04	Connecting cord
32. 103.25.18	Test lead
33. 42-531-Z1W13	Conductivity test-instrument
34. 42-253.01-Z1W109	Synchro test-instrument
35. 42-253.01-Z1A96	Synchro pattern plate
36. 42-253.01-U443W5	Bending tool for synchro arm
37. 42-253.01-U443W6	Bending tool for synchro arm nose
38. 42-253.01-Z1A97	Electronic flash pattern
39. 42-253.01-76W2	Key for electronic flash eccentric
40. 42-253.01-Z1A89	Sprocket wheel gauge
41. 42-253.01-Z1A59	Torsion gauge for compensation friction
42. 042-782.001-001-Z1W1	Take-up spool
43. 42-253.01-597W2	Delayed action retaining screw (key)
44. 42-253.01-Z1A76/42-582.01-Z1W4	(Set) Zero setting gauge (flange ring)
45. 42-253.01-535W15	(Set) Lathe jig (flange ring)
46. 42-582.03-Z1W1	Eye piece
47. 42-582.01-Z1A10	Distance setting gauge
48. 42-253.01-703W2	Angle screwdriver (roller arm)
49. 42-582.03-Z1W6	Screwdriver (Range-viewfinder height adjustment)
50. 42-253.01-700W2	Bending tool (roller arm)
51. 42-253.01-630W6	Screwdriver for eccentric cam "A" (roller arm)
52. 42-582.03-62W2	Key for guide rivet (parallax)
53. 42-253.01-Z1A107	Frame setting gauge
54. 42-253.01-Z1W84	Release locking pin
55. 42-253.01-Z1W7	(Set) For Range-viewfinder adjustment

Exposure Meter

56. 42-655.01-Z1W7 and 42-655.01-Z1W22	Calibration and Test-instrument (exposure meter)
57. 3.719.004.01/5W1NY	Key for retaining screw (1)

TOOL NUMBER	WHERE USED
	Lenses
58. 42-672.01-3-1W1NY	For 35mm lens
59. 42-37.01-U60W3NY	Spanner for retaining ring
60. C42-37.01-U60T6	For 135mm lens
61. 42-630.01-Z1A6NY and 16.486	Ground glass housing with magnifier (for image sharpness)
62. 42-630.01-Z1A7	Target
63. C42-37.01-U60T1NY	Knurled screws (for 135 viewing unit)
	Flash Unit
64. 42-471-117W3NY	Ring nut
65. 42-471-296W4NY	Round nut
66. 42-471-U48W1NY	Contact spring assembly
67. 42-471-U39W2NY	Contact spring assembly
	General Tools
Tweezers	Protection boxes
Flat pliers	Torch
Round pliers	Center punch
Plastic syringe	Diagonal cutter
Vise	Hammer (plastic or wood)
Tool and Lubrication stand	Hammer (steel)
Set of screwdrivers	Acto knife
Tap and Die set (metric)	Lupe
Micrometer (metric)	Files
Caliper (metric)	Soldering iron

APPENDIX B

REFERENCES

The following publications contain information applicable to the operation, maintenance and repair of Camera Set, Still Picture KS-15(4).

TM 11-6720-244-12	Operator and Organizational Maintenance: Camera Set, Still Picture KS-15(4)
TM 11-6625-203-12	Operator and Organizational Maintenance: Multimeter AN/URM-105, including Multimeter ME-77/U
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8 and 9), Supply Bulletins and Lubrication Orders
TM 11-401	Elements of Signal Photography
TM 38-750	Army Equipment Record Procedures

NOTE

This booklet (Part 2) contains figures 21 through 52.

Figures 1 through 20 are not used in the repair training program and do not appear in part 1 or part 2.

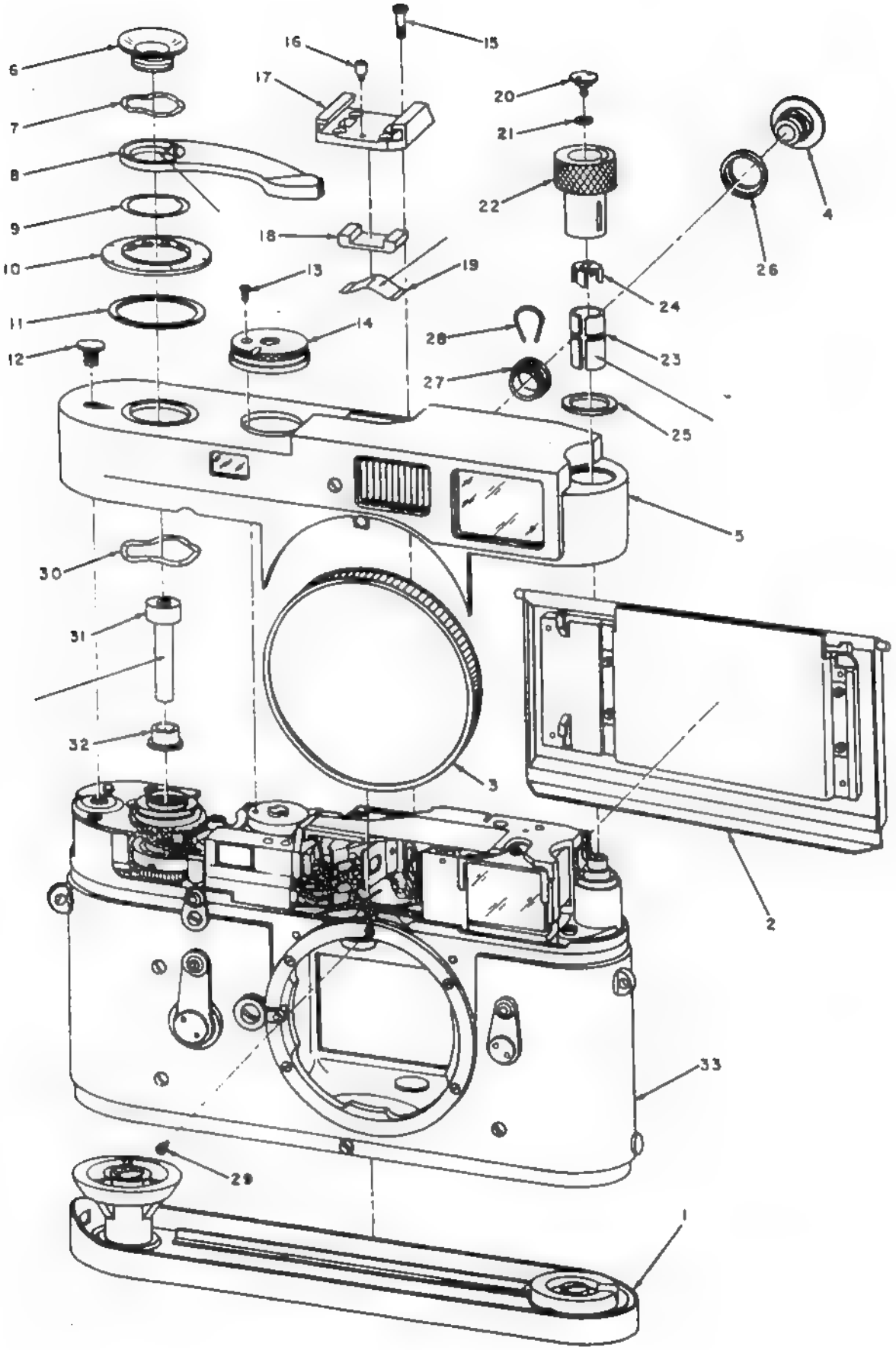

Figure 21. Top Plate Removed, Exploded View.

Figure 21, Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Baseplate		
2	Hinged back		
3	Body cover		
4	Flash socket cover		
5	Top plate		
6	Screw ring		
7	Saddle spring	Apply lightly all over	F–B
8	Winding lever	Wipe on inside bearing surface	F–T
9	Spacer		
10	Counting dial		
11	Felt ring	Place on under side	I–B
12	Screw	Place small amount on threads	N–T
13	Screw	Place small amount on threads	N–T
14	Speed dial		
15	4 screws	Place small amount on threads	N–T
16	Stop screw		
17	Accessory clip		
18	Pressure plate		
19	Spring	Apply lightly all over	F–B
20	Screw	Place small amount on threads	N–T
21	Washer		
22	Rewind knob		
23	Slotted friction sleeve	Apply lightly on outside	A–F
24	Forked carrier		
25	Retaining ring		
26	2 Cover rings		
27	2 Bushings		
28	2 locking springs		
29	Screw	Place on top of screw	M–T
30	Saddle spring	Apply lightly all over	F–B
31	Release knob	Apply lightly on outside of shaft	F–B
32	Release sleeve		
33	Camera body		

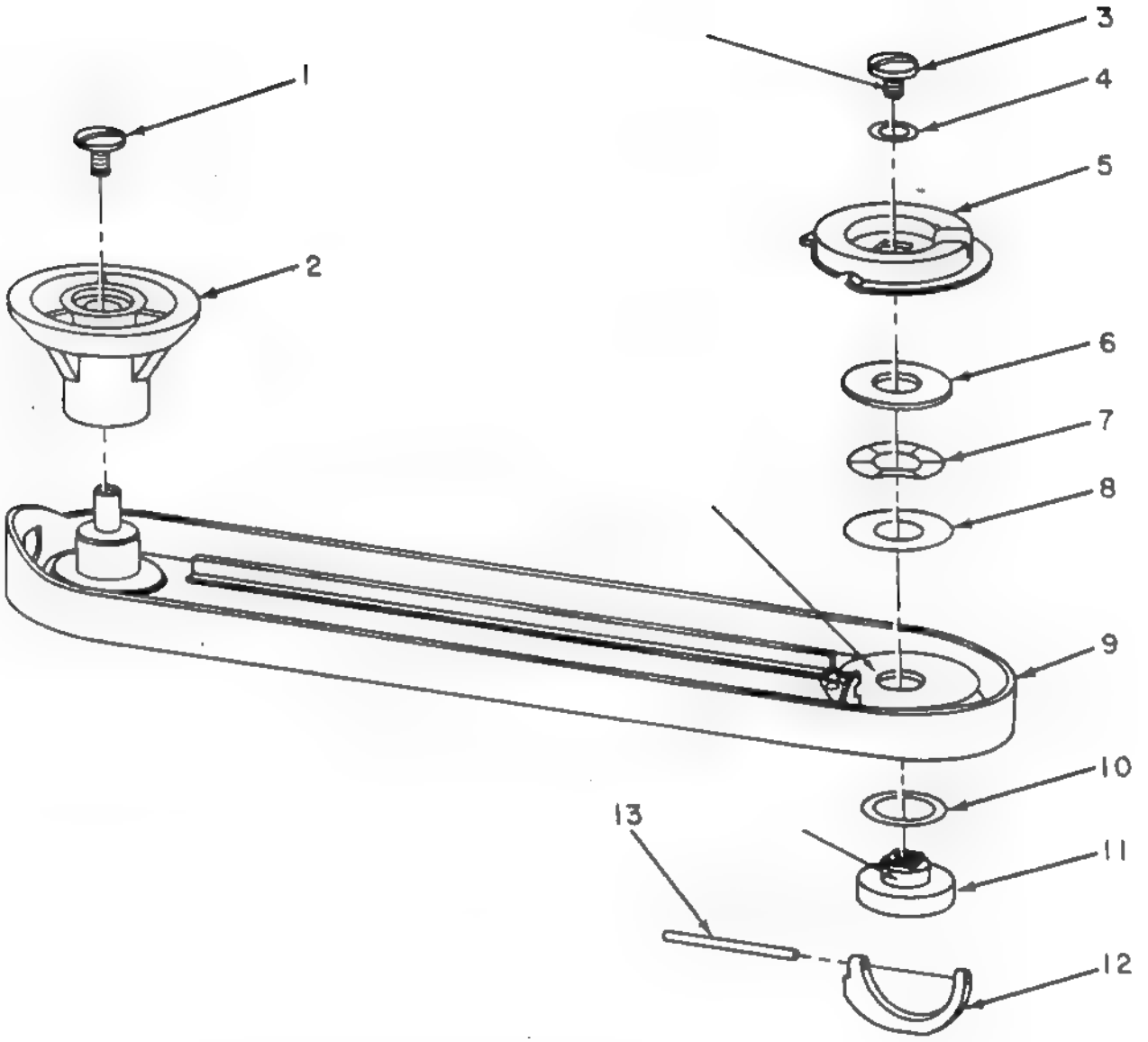

Figure 22. Baseplate Assembly, Exploded View.

Figure 22. Legend, Lubrication and Gluing Points

PART	DESCRIPTION	REMARKS	ADHESIVE OR LUBRICANT
1	Screw	Place small amount on threads	N–T
2	Film positioning disc	Wipe on inside bearing surface	F–B
3	Screw	Place small amount on threads	N–T
4	Washer		
5	Locking plate		
6	Washer		
7	Washer		
8	Washer	Place small amount on under side	A–B
9	Base plate		
10	Washer		
11	Lock stud	Apply small amount on shaft	A–B
12	Handle		
13	Pin		

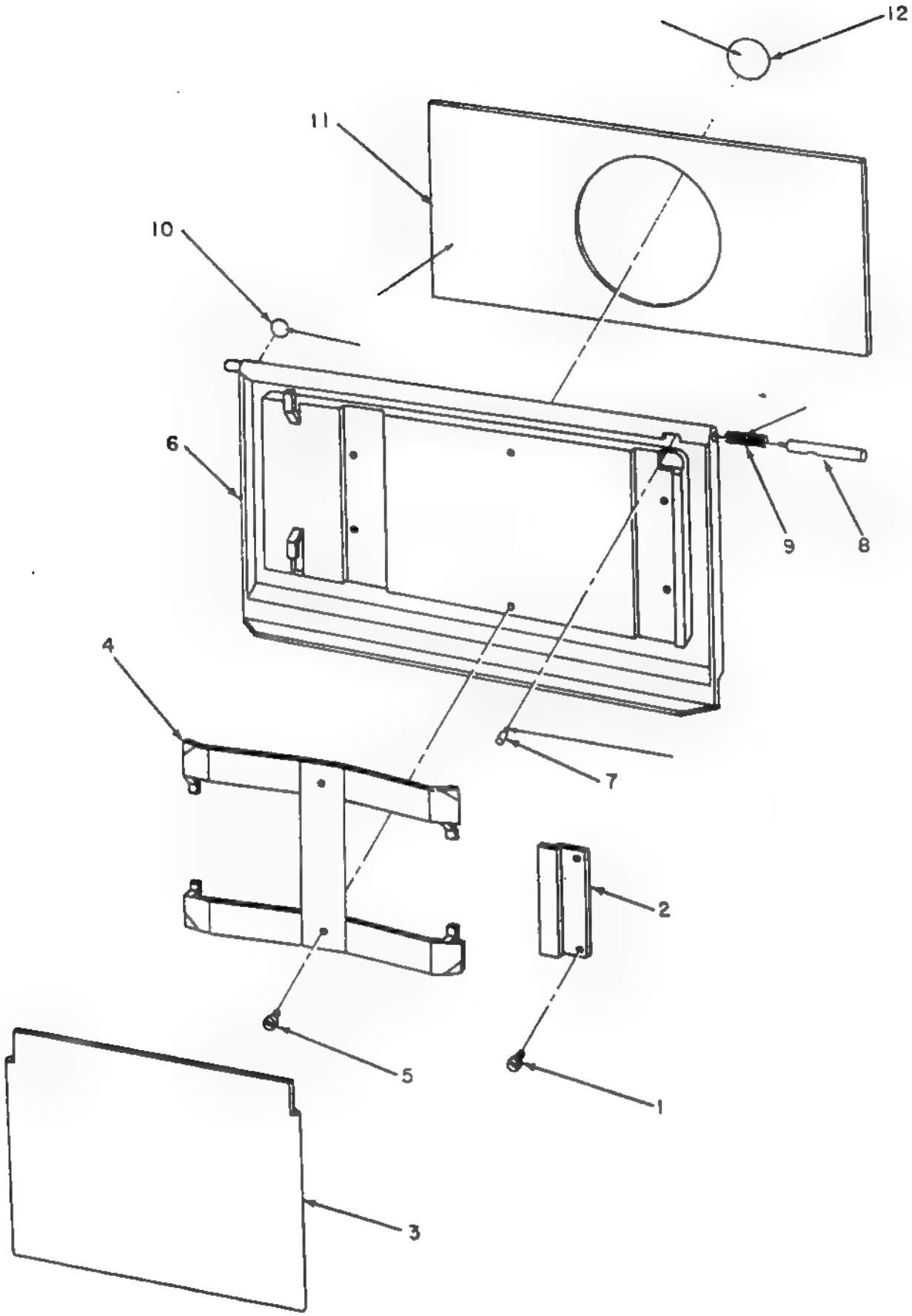

Figure 23. Hinged Back, Exploded View.